

POPULAR SCIENCE

FOUNDED MONTHLY 1872

JUNE

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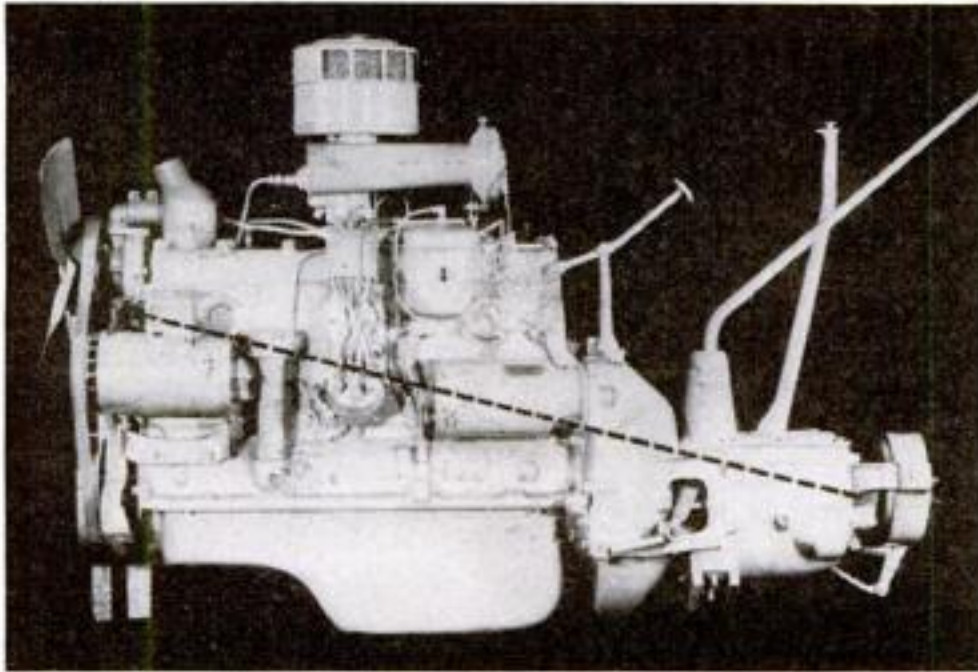


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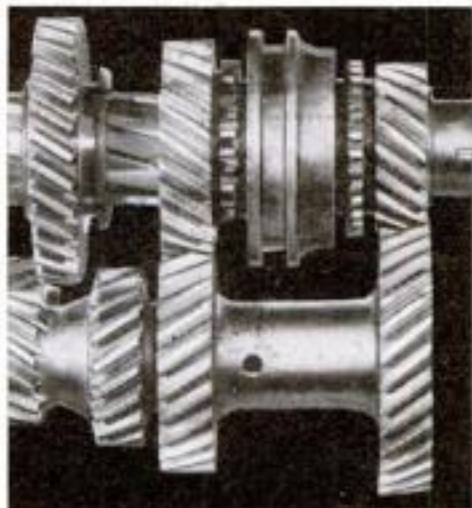
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ALL SPEEDS QUIET—costly helical gears for every speed. Syncrosilent transmission... shifting is noiseless at any speed... and it requires almost no exertion.

Everything easier for the driver
...and passengers all have more
room and comfort... in the
big new Plymouth

"SO EASY a child could drive it!"—that's literally true, today, of a car as modern as this.

With a worm-and-roller type steering gear, and three anti-friction roller bearings, a slight wrist motion controls the wheel. Cross-steering keeps the wheel free from "road shock."

The clutch is ingeniously *air-cooled*. Facings have longer life. The pedal requires 30% less pressure! Genuine hydraulic brakes, of course, need only a touch to stop you quickly, smoothly, without swerving... they're the safest brakes made.

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Many engineering advancements contribute to the restfulness and comfort of Plymouth's Floating Ride.

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Find out for yourself how much *more* fun it is to ride in and drive the new Plymouth. Ask your Chrysler, Dodge or De Soto dealer. Prices now only \$510 and up, list at factory, Detroit... with most convenient purchase terms, to fit your budget, by the official Chrysler Motors Commercial Credit Plan.

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SEATS AND ENGINE moved forward... give more room as well as smoother riding... no bumps or bouncing even over rough, rutted roads.



THRILLING SPEED AND POWER... more power and acceleration than ever... on 12% to 20% less gas and oil!

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POPULAR SCIENCE

FOUNDED MONTHLY 1873

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TABLE OF CONTENTS for JUNE, 1935

Weird Electrical Freaks Traced to Runaway Radio Waves . . .	11
<i>Startling effects of high-power broadcasting revealed by ALDEN P. ARMAGNAC</i>	
Amazing Tests Create New Race of Giant Bees	14
<i>GEORGE RANDALL McCORMACK reports on recent feats of an expert breeder</i>	
Good Samaritans of the Road	20
<i>BILL ELLIS reviews exciting moments of his ten years with the highway patrol</i>	
Four Miles a Minute in a Flying Baby Buggy	24
<i>LEE MILES, veteran pilot, tells of hair-breadth escapes in midget racing planes</i>	
Army's Animated Cartoons Make Better Soldiers	30
<i>Uncle Sam's latest way of teaching military tactics, explained by JAMES NEVIN MILLER</i>	
Pleasure and Profit in Raising Dogs for Sale	38
<i>WALTER E. BURTON gives pointers on an enjoyable way to make money</i>	
Strange Cargoes Ride Newest Tank Cars	42
<i>JOHN E. LODGE describes a dramatic and little-known side of railroading</i>	
Mechanical Fun-Makers Add New Thrills to Modern Carnivals . .	49
<i>Right this way, ladies and gentlemen, for a view behind the scenes with EDWIN TEALE</i>	

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FEATURES AND DEPARTMENTS

New Tools for Home Repair Jobs . . .	4
Our Readers Say—	6
The Man with the Net	33
Secrets of Hair and Feathers	40
Home Tests with Solutions	46
Here's the Answer	48
New Ideas for the Radio Fan	53
An Eighty-Meter Portable Set	54
How to Adjust Shock Absorbers	56
The Home Workshop	57
Table-Top Photography	70
Helpful Hints for Motorists	72

Cover Design by EDGAR F. WITTMACK

AUTOMOBILES

War Tank Does Nose Dive	16
Car Runs on Two Wheels	19
Machine Watches for Stolen Cars	26
Governor Checks Speeders	26
Winch Tows Car from Mud	27
Tank Runs on Land or Water	27
Odd View of Auto Fenders	27
Tricycle Guides Bus in Fog	34

AVIATION

Plane and Auto in One	17
Device Warns of Stalling	37
Plane Exhaust Is Signal	110

HEALTH AND HYGIENE

Artificial Larynx Electrified	19
Three-Dimension X-Ray	28
Exerciser for Eye	28

POPULAR SCIENCE MONTHLY FOR JUNE, 1935

Vitamin Food Made from Carrots	31
Meter Tests Water in Pool	37

MODELS

Five-Foot Stagecoach Model	32
Miniature Show Boat	65
Transport Plane Model	69
Printed Letters for Names	83
Show-Boat Construction Kit	92

NEW DEVICES FOR THE HOME

Rolling Ash Receiver	44
Revolving Light Shades	44
Novel Hot-Water Bag	44
Thimble Threads Curtains	44
Empties Vacuum Cleaner Bag	44
Jer Cap Easily Loosened	44
Kit Etches Glassware	45
Lamp Aids Foot Care	45
Chair Folds Easily	45
Brush for Venetian Shades	45
Ironing Board in Table	45
Shoe-Shining Outfit	45
Iron Carries Own Stand	45

NEW PROCESSES AND INVENTIONS

Bumper Guards Ax Blade	16
Radio Tubes of Metal	17
Kit for Making Stilts	18
Rocket Carries Rescue Aid	19
House Is Factory Built	23
"Vacuum Cleaner" Harvests Grain	26
Outfit Mends Band-Saw Blades	27
Revolver Pierces Armor Plate	28
Odd Craft Rolls on Wheels	29
Forest Fire Danger Meter	29

New Harvester for Rubber	32
Coin Bank in Shaving Brush	32
New Hand Routing Tool	32
Novel Comfort Meter	33
Caps Guard Poison Bottles	33
Stamps in Fountain Pen	34
Liner Has Lifeboat Chutes	35
Plunger Charges Air Pistol	35
Standardized Building Parts	36
Scraper Has Many Uses	36
New Undersea Escape Device	37
Mincee Unwanted Papers	37

PHOTOGRAPHY

Tailor Aided by Camera	16
Home Movies in Color	17
Pioneer Perfects Depth Movies	18
Non-Skid Tripod Brace	33

UNUSUAL FACTS AND IDEAS

Laundry Marks Trap Crooks	16
Mystery in Desert Gems	16
Rope Bumpers Protect Ships	18
Racing Camels Leap Hurdles	18
Insect Army Starts War	18
Bicyclist Seeks New Speed	19
Peace Flag for Cultural Centers	19
Potatoes as Cattle Feed	19
Sulphur Mined by Blasting	22
Theater for Deaf Opened	26
Sailboats Turn Wind Toy	26
Magnets Clean Movie Lot	28
Odd Facts about Metals	29
Do Pygmies Talk to Gorillas?	29
Fire Trucks Carry Radio	32
Muffler Quiets Diesel Tanker	33
Odds-and-Ends Power Plant	34
Spray Gun Paints Pictures	34
Vertical Sidetrack in Tunnel	34
Robes Camouflage Soldiers	35

Styles in Streamlined Engines	36
Schoolhouses Are All Cellar	36
Cannon End Snowslides	36
Dogs Get Meals by Car	37

FOR THE HOME OWNER

Cement for Celluloid	68
Preserving Your Skis	69
Plugging Auger Holes	75
Matching Plaster Colors	79
Test Shows Lacquer Is Dry	79
Fastening Nails in Plaster	81

WOODWORKING

Home Workshop Exhibition	57
Our New Racing Runabout	60
Fairy-Tale Cottage for Garden	66
A Chippendale Lowboy	67
Low Seat in Medieval Style	68
Double-Deck Beverage Tray	74
Home Workshop Blueprints	78
Seats for Family Circle	86

IDEAS FOR THE HANDY MAN

Back-Yard Playground	62
Laying Out a Workshop	62
Maximum-Minimum Thermometer	63
Toy Warship Blows Up	64
Pool Conceals Foundation	66
Aid for Perspective Drawing	68
Device Kills Lawn Weeds	68
Rainproof Window Ventilator	75
Ornamental Celluloid Handles	80
Shop-Built Arc Welder	84
Homemade Concrete Mixer	89
Warming Reduces Drill Breakage	89
Cutting Tools from Files	97

In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

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You're sure to get more pleasure out of driving your car if it is Simonized . . . for then the finish will stay beautiful. With practically no effort at all, the new, improved Simoniz Kleener quickly brings back all the lustre your car had when new. Although easy to apply, Simoniz is hard for weather to wear off. It not only gives perfect protection to the finish, but makes it last longer. So, new or old, the sooner you Simoniz your car the better.

THE SIMONIZ CO., CHICAGO, U. S. A.

NEW TOOLS AND METHODS FOR Home Repair Jobs



ROOFING HAS LOCK JOINTS

Metal roofing that automatically locks itself in place is one of the latest developments in building materials. Provided with carefully designed saw-tooth edges, the sheets of metal can be ingeniously interlaced to form seams that remain tight against high winds as well as driving rains. Because of the nature of the joint, all nails used in laying the roof are thoroughly covered. As shown in the photograph, an ordinary claw hammer is the only tool required to make the lock.



VARNISH IS WIPED ON

APPLIED with a cloth instead of a brush, a novel varnish recently placed on the market hits a new high for convenience. Consisting of a base of long-wearing synthetic resin, it is simply wiped on the surface to be finished. In less than two hours it hardens to a tough, lustrous finish that resists alcohol, acid, water, harsh soap, heat, and wear. It can be used on tables, floors, linoleums, bridge-table tops, golf clubs, metal fixtures, leather chair seats, and any other surface that requires a protective glasslike finish.



A glasslike finish can be wiped onto furniture, floors, and other surfaces with a new varnish.

DRY CLEANER FOR WALLS AND DRAPES

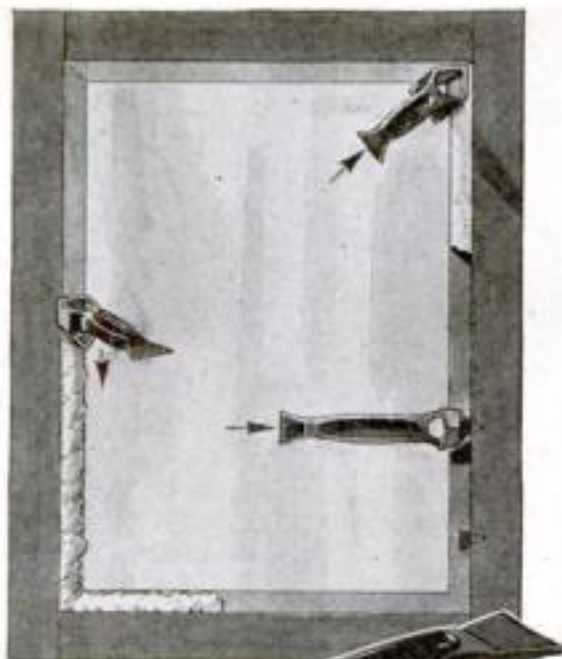


Papered or plastered walls can be cleaned with an inexpensive preparation without streaking.

FOR renewing walls, window shades, cretonnes, and tapestries, the home owner can make use of a novel and inexpensive dry cleaner. Sold in cans and resembling putty, it can be used on ordinary or washable wallpaper, plain or textured plaster, and oil or water paints. It is simply kneaded into a small ball and rubbed like an eraser over the surface to be cleaned. Because it is dry and contains no water, it is said to do the work without muss or streaking.

SOAP LOOSENS WINDOWS

WINDOWS that tend to jam and stick in muggy weather often can be made to slide more easily with ordinary soap. Simply cut a slice from the bar and rub it over the inner rails of the window frame. It will lubricate the wood and make up for any swelling unevenness. The same trick can be used to "grease" the rails that hold the sliding type of window screen in place. These rails often jam as a result of warping.



This new putty tool has several uses, as shown in the drawing

TOOL FOR PUTTY WORK

TO SIMPLIFY the problem of glazing windows, the low-cost, four-purpose tool illustrated has been developed. Tapering to a sharpened point, one end serves to remove old putty, while an angular knob at the other end provides a smoothing iron for pressing the putty into place, a right-angle for squaring puttied corners, and a flat surface for driving glazier's points. It can be stored easily in any tool kit.

CLEANING TILE FLOORS WITH MURIATIC ACID

ALTHOUGH excess cement and plaster can be removed from tile with a sharp knife or a razor blade, a better job with less effort can be obtained by using a mixture of muriatic acid and water. To make the solution, add one part of the acid slowly and cautiously to ten parts of water. Carefully apply a small amount of the mixture to the plaster spots and then rub them briskly with one end of the oil-stone you use for sharpening tools. Work quickly so that the acid is not left on the tile any longer than is necessary to remove the spots and, when you are finished, wash the surface thoroughly with water. This same acid solution can be used for cleaning and brightening brick mantels and similar pieces. Simply scrub the surface with a stiff brush (an old floor brush will serve) and then sponge it down with water.

NEW ENAMEL REFINISHES WORN LINOLEUM CHEAPLY

BY MAKING use of a special stippling sponge and an enamel compounded especially for floors, worn linoleum can be refinished at surprisingly low cost. The enamel, free-flowing and easy to apply, hardens to a tough, durable coating that withstands both scrubbing and the scuffing of feet. According to available figures, the linoleum floor of an average-size kitchen can be completely refinished by this method for less than two dollars.

Sealed in a fortress of steel!..



Now in all three types of G-E Refrigerators

The "ageless" Mechanism of GENERAL ELECTRIC REFRIGERATORS

Carries 5 years Performance Protection for only \$1 a year!



•All three types of G-E Refrigerators—Monitor Tops, Flatops and Liftops—are now powered with "ageless" sealed-in-steel mechanism.

The mechanism, of course, determines how well and how long any refrigerator will serve you. G-E Monitor Tops have been cut open at General Electric Research Laboratories and found to be in such first class condition *after five, six and seven years of use*, that it is impossible to place a limit on the years of service to be expected from this matchless mechanism.

Forced Feed Lubrication

3 to 4 quarts of oil are forced to every bearing surface under 6 to 8 pounds pressure. Bearings are self-aligning. Acoustic mufflers silence operating sound. Valves are tested for 100 million cycles of operation. In tests with many open type refrigerators, the General Electric shows 15% to 50% lower operating cost.

All-Steel Cabinets • Stainless Steel Super-Freezer that cannot chip or tarnish • Sliding Shelves • Interior Lighting • Foot Pedal Door Opener • Vegetable Drawer • Temperature Control and Defrosting Switch.

General Electric Company, Specialty Appliance Sales Department, Section M-6, Nela Park, Cleveland, Ohio.



General Electric Monitor Top



General Electric Flatop



Monitor Top Model X-4

General Electric Liftop

Prices as **\$77.50**
low as .. **\$** f.o.b.

Our Readers Say



What is This Self-Anchoring Microscopic Animal?

JUST now I looked through my microscope and saw a bit of algae and some large protozoa. They were about the same size as ordinary rotifers, but they did not move as the rotifers do. They were attached to a strand of algae. Apparently they never move from the position in which they attach themselves. Their internal organs are always in motion, however. They do not have anchoring threads, but seem rather to use their short tails. What are they, readers?—H.D.M., Peru, Ind.



Anyway, It's a Cowardly Thing To Do

NEARLY everybody knows that the legs of a bullfrog will keep on kicking for a long time after the frog is dead. They even kick in the pan while they are being fried. But how many of your readers have had the experience of shooting a bullfrog in the back with a rifle and seeing him fly through the air for a great distance? If hit squarely on the backbone, a big bullfrog will jump fifty or sixty feet. Of course, it takes careful maneuvering to get into a position for such a shot, and good marksmanship to make it. I'd suggest this as an experiment for your biology fans.—J.T., Knoxville, Tenn.

In One Thing, At Least, England and U. S. Are Last

WHILE they're talking down at Washington about "new deals" and "yardsticks," how about giving the yardstick itself a new deal? Adopting the metric system of weights and measures, it seems to me, would be a reform well worth while, and no more startling than other changes we've seen in the last few years. In fact, every civilized country but England and the United States uses it already.—C.G.S., Hartford, Conn.

Will Canvas Wings Be Used In All Parachute Descents?

IN THE May issue of POPULAR SCIENCE MONTHLY, you told how a daring and enterprising young aviator dropped from a plane, and, by means of canvas wings attached to his arms, did a series of graceful glides and swoops before opening his parachute. Since he proved he could maneuver about in the air almost at will, why not supplement all parachute equipment with wings? It would help pilots to glide free of disabled or burning planes, make it easy for them to avoid landing in wooded country, lakes, rivers, and city streets, and help to break the sudden shock of opening a parachute after a free fall of several thousand feet.—H.T.S., Reno, Nev.



Now that Synthetic Perfumes Are the Fashion—

WITH fire-insurance companies using advertising literature treated to smell like smoke and burned wood, textile manufacturers perfuming tweed cloth with peat-smoke odor, and restaurants snaring customers with the synthetic aroma of coffee, why can't you publishers scent outdoor magazines with balsam, and travel magazines with the odor of the sea? POPULAR SCIENCE MONTHLY, of course, would smell like wood shavings.—D.C., Rye, N. Y.

Two Machines the Inventors Have Overlooked

THIS old-time reader is still amazed at the variety of things people invent. I can think of only two things left: an automobile that will burrow its way under ground, and a submarine driven by rockets. I wait and hope.—P.F., Hammonton, N. J.

Judges Must Know Their Science, Today

IN THE Northwest, the owner of a bed of clams is suing a steamship line. He says the clams, sensitive to noise, are "disturbed, annoyed and harassed" by the boats passing over them in low water. In Holland, a former midget has sued a doctor for damages. His complaint is that in curing him of grippe, the doctor stimulated his glands and thus caused him to grow to normal size and lose a valuable circus contract. Believe me, judges, these days, have to know their science to tell whether complaints are legitimate or poppycock. It might not be a bad idea to make POPULAR SCIENCE MONTHLY part of the required reading at law schools.—J.C., Chicago, Ill.



Forecasts Popularity For Steam-Propelled Cars

BEING a steam-automobile enthusiast along with F.H., L.C., and F.R.V., I would appreciate an article about steam automobiles. I believe they have so many advantages, that I am expecting them to become much more plentiful almost any time. For some time now, it is claimed, steam boilers for automobiles have been made absolutely explosion-proof.—R.J.L., Elmsford, N. Y.

Can Someone Identify This Lavender Butterfly?

LOVERS of birds and butterflies will perhaps be interested in a strange association of the two that I observed not long ago. Early one morning I found a birch wood, of young saplings, full of towhees (towhee buntings, or chewinks) and, keeping very quiet, I watched them for a long time. As soon as the sunlight began to filter through the trees a strange kind of butterfly came out in great numbers, and seemed to fly unmolested among the towhees.

This butterfly was about one inch long, and was of a very brilliant lavender, somewhat chalky, and lustrous. The birch wood of which I write was in a marsh. I would like to know the name of the lavender butterfly, and also some amateur naturalist's reason for the presence of the towhee and this butterfly in the same habitat.—B.C., Port Jervis, N. Y.

A Plea in Praise of the Coast Guard

I AM very much interested in your articles on the construction of ship models of all types. You have had many good articles, and I appreciate all of them. The Navy and the Merchant Marine have been well represented by your models. Why not give the other branch of our seagoing service, the Coast Guard, an opportunity to be represented? With the Coast Guard figuring in so many heroic rescues during the last few months, it would be fitting indeed to have a model of one of the Coast Guard cutters, such as the *Sebago*, or the *Cayuga*? What do you think?—W.E.M., Pawtucket, R. I.



Digging Ditches is Worth A Dollar a Foot

VERY much do I enjoy working the problems sent in by other readers. Now I am going to ask them if they can solve this one: A firm hires two men to dig a ditch fifty feet long. (The depth and width don't make any difference.) They contract to do the job for \$50, making it at the rate of one dollar a foot. The two men, one at each end of the ditch, start the job, and find that one end of the ditch is much harder to dig than the other. So they agree for one to dig his portion at the rate of \$1.25 a foot, the other at the rate of 75c a foot. When either of the two men has dug his \$25 worth, is there enough of the ditch left for the second to earn his \$25?—J.S., Rowland, N. C.

Strong Feeling Enters The Dispute on Snakes

FULL of bitter fury and vilification of the "snakeologist", F.P., of Bloomfield, Mich., alleges that some snakes actually strike beyond their own length, spring at their victims bodily, swallow their young, and roll down hill hoop-fashion. To him a "snakeologist" apparently is one who prefers what reliable herpetologists tell him about the habits of snakes to the lore he gets from his second cousin-in-law's great-grandmother by way of the gossipy route of back fence myth-mongering. For dependable information tending to show the legitimate place of snakes

WHEN CAN I GET INTO THIS FREE-FOR-ALL?



CHEVROLET'S PRESSURE STREAM OILING

forces oil to the bearings at the rate of 120 miles per hour when the car is traveling at 40



Pressure Stream Oiling—employed in the 1935 Chevrolet—is as simple in operation as it is efficient in results. Oil is forced *under pressure* along the path of each connecting rod dipper from the direction opposite that of the connecting rod rotation. Result: A veritable deluge of oil on the bearings—efficient lubrication at all engine speeds.

CHEVROLET Think of it! . . . When your Chevrolet is traveling 40 miles an hour, oil is forced to the connecting rod bearings at the rate of 120 miles an hour. . . . And the Chevrolet oil pump forces 8.5 quarts of oil per minute! Pressure Stream Oiling—*exclusive to Chevrolet in its price class*—means that the oil is sent under pressure along the path of each connecting rod dipper from the direction *opposite* that of the connecting rod rotation . . . thereby assuring an adequate supply of

oil at all engine speeds. Much of the smooth operation . . . capacity for sustained speed . . . and long-lived reliability for which Chevrolet cars are noted is due to this *extra-efficient* oiling system. Chevrolet engineers design and build *every* part of the New Standard Chevrolet and Master De Luxe Chevrolet with painstaking skill. See and drive these new cars—prove their excellence—and choose *Chevrolet* for quality at low cost.

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

Compare Chevrolet's low delivered prices and easy G. M. A. C. terms. A General Motors Value

CHOOSE CHEVROLET FOR QUALITY AT LOW COST

FEATURES

Turret-Top Body by Fisher
(with Fisher Ventilation System)
Blue-Flame Valve-in-Head Engine
with Pressure Stream Oiling
Improved Knee-Action Ride
Weatherproof
Cable-Controlled Brakes
Shock-Proof Steering



in the scheme of things, see the leaflets of the Biological Survey, bulletins of the New York Zoological Society, the Zoological Society of San Diego, Calif., of the Pennsylvania Department of Agriculture for 1906, and of the Carnegie Museum. About thirty years ago a reward of \$500 was offered for a specimen of a hoop snake, and none of the snake's backers cashed in.—C.A.B., Lancaster, Pa.

Another Reason Why Men Like Ship Models

I THINK I have discovered why there is so much pleasure in building ship models. Pride of craftsmanship comes first, of course, because it is natural in every man to wish to make things well, with his hands. But I have found also that while I work, I go adventuring with the men who toiled as sailors, and who gave commands, as officers, on the prototype of the vessel I am reproducing. It is easy to find oneself climbing into the crosstrees, and lying out on the yards, his heels clinched in the footropes, in a raging hurricane, rounding the Horn. How often do I think, in the pleasant solitude of my workshop, of being master of some rakish barkentine cruising the Caribbean with her hold full of Aztec gold. I know only a couple of chanties, but I like to sing them while I work. Do some of you others go adventuring, too?—J.H.S., Helena, Ark.



How Cold Is It When The Thermometer's Frozen?

I'D LIKE to ask some of your good mathematicians a couple of embarrassing questions, if you don't mind. I think it's funny to embarrass people who are serious. Anyway, how cold is it when the mercury has been at zero one day and weather man says it's twice as cold the next day? And what is the temperature? There is nothing like common sense. Is it common sense for the newspapers to say, as they frequently do, "And the mercury dropped to fifty below zero," when mercury freezes at around thirty-eight below, and alcohol is used to record all lower temperatures? What about it?—T.P.W., Minneapolis, Minn.

A Train That Was Pointed at Each End

CONSIDERATION of one brief mathematical principle sometimes leads to discovery of a great idea. I am thinking of the principle of streamlining trains. All that one needs to know to begin with is that the air resistance varies as the square of the speed. From that start, look what has been done. In the last year of the Civil War—yes, as long ago as that—one S.R. Calthorpe obtained a patent for a train having pointed ends and a smooth exterior, and porthole windows. The scientist Jaray, who developed the forms for the Zeppelin, is the one who discovered that the round end should go in front and the pointed end at the rear. Streamlining is of great benefit even when the average speed of the train is only forty miles an hour. I see that one railroad, on one division, where forty miles an hour is the average speed, figures it can save \$17,118 a year by streamlining. The whole idea seems to lead to the derivation of a formula for inventing: first take the mathematical principle at its simplest, then work out the practical applications and you will get somewhere.—G.C.K., Easton, Pa.

GREAT OAKS FROM LITTLE ACORNS



It's a Long Worm That Has No Turning

THE monstrosity you gazed upon, W.C.L., through your trusty microscope, was a worm named Nais. Perhaps you observed its red blood and outward extending spikes. How about giving us microscope enthusiasts a hard one sometime? If you want to see a picture of Nais, you will find it on page forty-four of "Wonders Through the Microscope." Why can't we form a microscope club, exchange slides, and take advantage of each other's knowledge and methods? Perhaps we could have a central laboratory in somebody's commodious attic, and all get together and talk microscopy.—C.S., Brooklyn, N. Y.

A Warm-Hearted Letter From 'Stern Caledonia'

I WONDER if you know that your magazine is very widely circulated and read in "the land of brown heath and shaggy wood, land of the mountain and the flood." I myself have read it for seven years, and, during that time, have seen it in the shop windows of several towns in Scotland. This, I think, is proof enough of its widespread popularity. It's undoubtedly the most sane, interesting and bang-up-to-date publication of its kind that ever came out of America. More articles on radio, television, talking pictures, aviation, and modern ocean liners and other seagoing vessels would be very welcome. And, if it's not too tall an order to fill, I'd personally be tickled pink to see in POPULAR SCIENCE MONTHLY a good-length article on each of the following: the United States Military Academy at West Point, the United States Naval Academy at Annapolis, and Randolph Field, Texas; also, more about radio police cars. And last, but not least, an article on Alexander Graham Bell, the Scot who invented the telephone. All-in-all, it's worth the one shilling and threepence they charge for it here, and long may it be imported into "Caledonia, stern and wild." As a Clydesider, who was actually at the launching of the 534, christened the *Queen Mary*, by the Queen, I greatly enjoyed your recent article on Scotland's latest triumph.—G.R.H., Glasgow, Scotland.

HOOT MON!



Library Rescued When Stream Overflows

A STREAM went on the rampage recently near our cabin on the slopes of Mount Hood here in Oregon. In the rush for safety, one of the first things to be rescued was the bundle of copies of POPULAR SCIENCE MONTHLY. Issues of it are to be found by the hundreds in our camp library.—H.B.W., Portland, Ore.

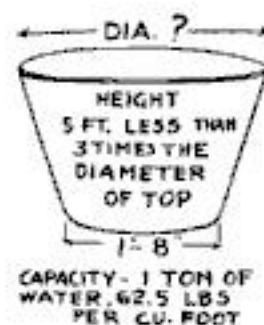
Proposes a 'Mirror Method' of Testing Home Lighting

TO ADJUST house lights to a degree of brightness compatible with safety to the eyes has always been extremely difficult. Consequently, visual defects are often suffered from protracted reading in poor light. Here is my method of avoiding such eye strain as this. Under ideal conditions, such as those existing in the shade of a tree on a sunny day, the iris of the eye contracts so that the diameter of the pupil is about one third that of the iris. Knowing this, it is easy enough for anyone to sit down under his favorite reading lamp and, after allowing a few minutes to elapse so that the eyes may accustom themselves to its light, to hold up a mirror before his eye, and immediately ascertain whether the pupil is too large or too small, according to the norm above described. If it is too large, the light is

too weak; if it is too small, then the light is too bright.—A. B., New York, N. Y.

A Problem Handed Down From Father to Son

BECAUSE this problem was originated by my father, I feel quite positive it will be new to the readers. I feel certain, also, that it will interest your mathematically inclined readers for at least one busy evening. Here is the problem: a round tank with sloping sides has a bottom diameter of one foot, eight inches. The depth of the tank is five feet less than three times the diameter of the top. What must be the diameter of the top, for the tank to hold one ton of water, allowing sixty-two and five tenths pounds per cubic foot?—L.A.C., Athol, Mass.



He Wants to Go on Fishing While We Do the Work

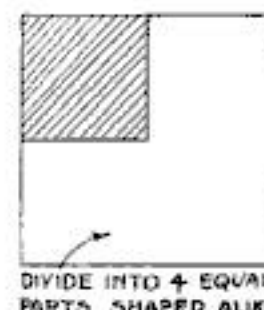
WHEN some of you zoölogy bugs are busily turning the pages of the huge brass-bound tomes in which you learn what is the Latin name for the Pinching Bug, and what word the Greeks had for the Killyloo Bird, you might look something up for me. I'll be fishing off the rocks out here, for big rock cod, and I'll be using for bait the very worm that I want you to tell me the name of. It is brownish, and lighter on the back than on the belly. It is made of segments and looks like a strip of inner tube that something has been chewing on. It lives in the wet sand close under the rocks that litter the beaches of Puget Sound, and in the barnacles on the old piling under piers. On each side of its mouth is has a sickle-shaped prong or tooth with both of which it can nip you if you pick it up the wrong way. It is a darned good bait for rock cod, porgies, ling cod, sun perch, and almost every other fish. But the sea-run cut-throat trout refuse it.—W.M.L., Port Blakeley, Wash.

Wanted: a Solution of the Mystery of Sleep

A CURIOUS item in my morning paper has set me thinking. In England, an elderly lady sleeps continuously for three days, stays awake for three days and then sleeps for three days. Physicians are at a loss to explain her unusual sleeping habits. I am wondering what bodily mechanism has been upset. What turns us on and off, so far as sleep is concerned? Why don't we all sleep longer periods and stay awake longer?—A.F., Boston, Mass.

Solve This, So the Farmer's Boys Can Live in Peace

THIS problem has won me a few wagers at various times. I think others will enjoy trying to work it out. It is somewhat baffling, as a brief reading-over of the wording will show. But it has a solution that can be found, so you can work at it with confidence. A farmer died, leaving four sons to inherit his farm, which was square. The conditions were that one quarter should be left for the homestead, and that the remainder be divided among the four sons, so that each would have a plot exactly the same size and shape as those of the others. Your job, and, I hope, pleasure, will be to find out what was the shape of each plot.—T.H. W., Bexley, Australia.





Making Money With Your CAMERA

Here is a brand-NEW, exceptionally practical manual which will teach you many kinks and tricks, ways and means to take and sell pictures. Written entirely for the amateur or semi-professional camera hobbyist, it clearly demonstrates by pictures and directions the principles of picture taking that bring you photos which are marketable—and how and where to sell them.

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Richest imported ale yeast now concentrated 7 times and combined with iron.*

NOW there's no need to have people calling you "skinny", and losing all your chances of making and keeping friends. Here's a new, easy treatment that is giving thousands solid, healthy flesh and husky strength—in just a few weeks.

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But that is not all! This marvelous, health-building yeast is then ironized with 3 special kinds of strengthening iron.

Day after day, as you take Ironized Yeast tablets, watch ugly, gawky angles fill out, flat chest develop and skinny limbs round out attractively. And with this will come a fine clear skin, husky new health—you're a new person.

Results Guaranteed

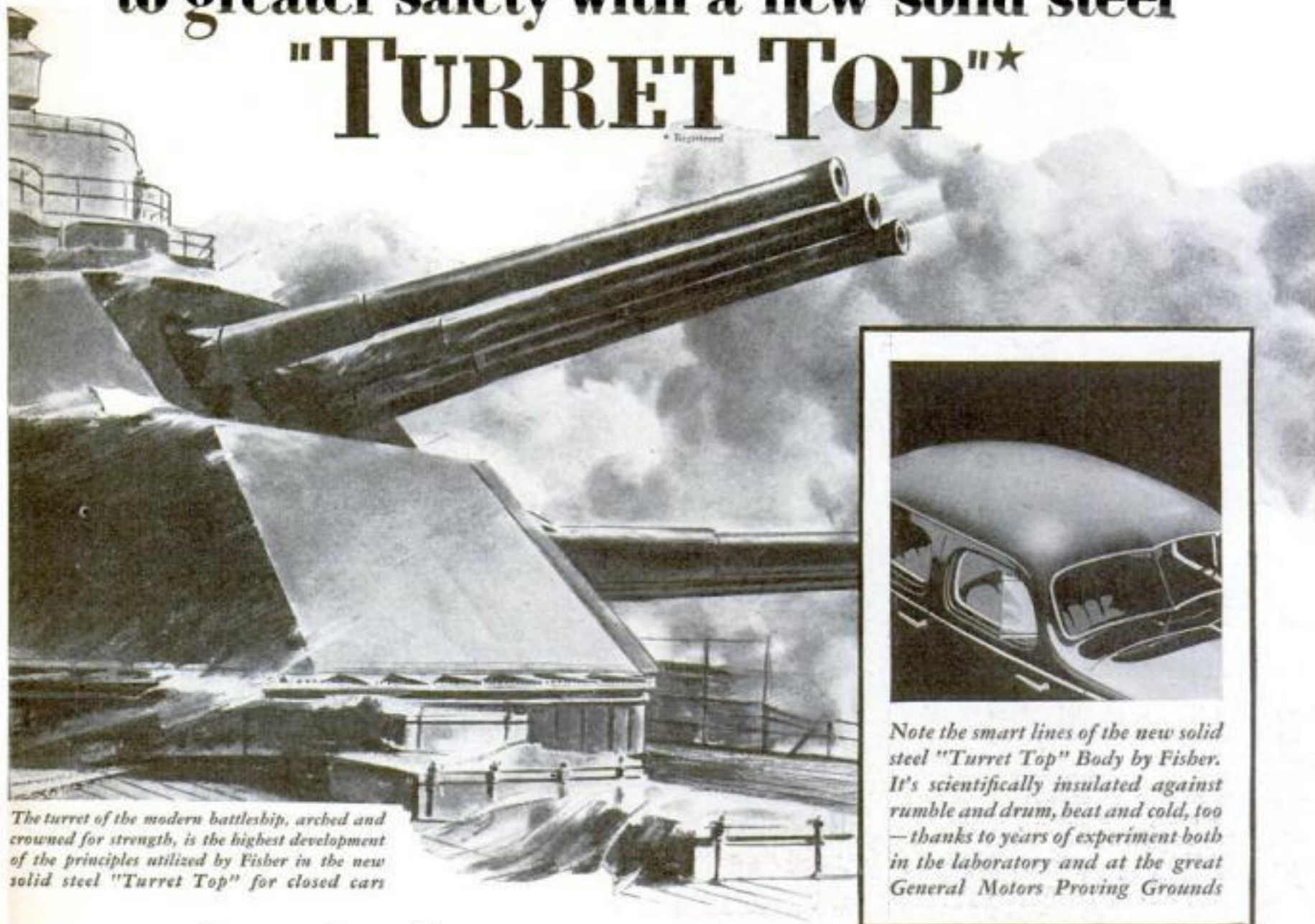
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The turret of the modern battleship, arched and crowned for strength, is the highest development of the principles utilized by Fisher in the new solid steel "Turret Top" for closed cars



Note the smart lines of the new solid steel "Turret Top" Body by Fisher. It's scientifically insulated against rumble and drum, heat and cold, too — thanks to years of experiment both in the laboratory and at the great General Motors Proving Grounds

Featured on all

CHEVROLET (Master De Luxe Series), **PONTIAC**
OLDSMOBILE, and LA SALLE

Closed car models for 1935

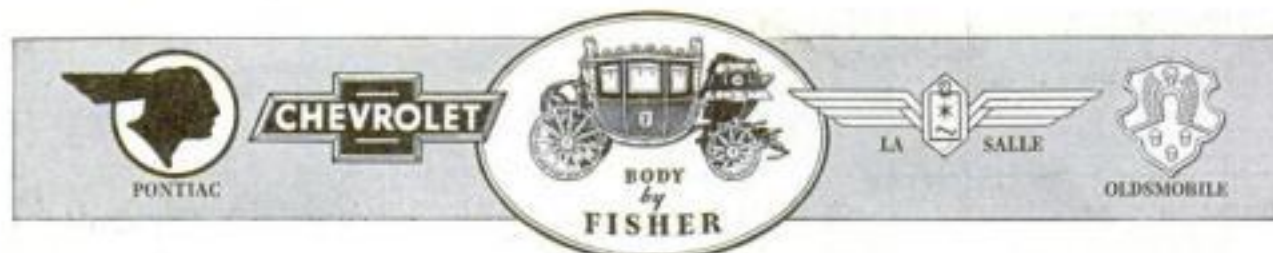
THIS remarkable new solid steel "Turret Top" Body by Fisher—now featured on 1935 Chevrolet (Master De Luxe Series), Pontiac, Oldsmobile and La Salle closed cars—is a solid protective roof of seamless drawn steel—steel braced with steel like the modern battleship turret from which it takes its name. It is supported by steel-roof-bows and is welded to the steel body panels. For the first time, it successfully provides the safety of solid steel *over your head*.

By rounding the corners, the principles of sphere construction are employed to give maximum

over-all rigidity and strength—as well as lower wind resistance and enhanced appearance.

Moreover, it is scientifically insulated against drum and rumble; and comparative tests, using "Turret Top" cars and cars with the conventional type roofs, conducted at Key West, Florida, under the sanction and supervision of the American Automobile Association, proved conclusively that the "Turret Top" can be depended upon for maximum coolness under hot-weather driving conditions.

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RAYMOND J. BROWN, *Editor*

WEIRD ELECTRICAL FREAKS

TRACED TO

Runaway Radio Waves

By
*Alden P.
Armagnac*

IF THE chairs and tables in your home began to talk and sing, you probably would refuse to credit your senses. Yet things just as strange are happening today in a little farming community at Mason, Ohio.

An ordinary-looking waterspout at the corner of a farmhouse hums the strains of a symphony, or declaims a dramatic bit from a play. A tin roof, next door, makes political speeches, or bursts into song. Inquire among the farmers of the neighborhood, and nearly all will tell you of hearing these mysterious, ghostly voices issuing from inanimate things.

A superstitious person might imagine the objects bewitched. The farmers know better. To a mystified visitor, they point out the near-by tower of broadcasting station WLW—a slender spire of crisscrossed steel, rising more than 800 feet toward the sky—as the source of the weird phenomena.

From this tower, which serves as a vertical antenna, engineers are unleashing the greatest power ever used in radio. When WLW goes on the air, 500,000 watts of electrical energy surge into the ether to carry its programs to the farthest parts of the globe. The magnitude of its power may be appreciated from the fact that the station consumes enough electricity to light all the homes of a city of 150,000 inhabitants.

When WLW's tower jars the ether with its torrents of electrical energy, it is as if the whole atmosphere near-by became saturated with it. Every metal object for more than a mile around becomes charged with electricity. The base of the tower, the center of the disturbance, is so dangerous to approach while the station is operating that it is enclosed by a brick wall plastered with warning signs. A metal gate in the wall becomes so highly charged that an electric arc will leap to a lead pencil, a key, or a pair of pliers held near it. From the arc thus drawn, which vibrates the air in exact time with the modulations of the radio program being broadcast, comes speech or music that can be heard fifteen feet away. If a man holds one of a pair of wires attached to a 100-watt lamp bulb in his hand, and extends the other wire toward the gate, enough electricity passes through his body to light the lamp.



SPARK GAP DRAWS MUSIC FROM THE AIR

A pair of pliers held near the iron gate that guards the base of WLW's powerful transmitting antenna near Cincinnati, Ohio, draws a "singing arc" from the metal. The music can be heard fifteen feet away.

**SUPERPOWERFUL BROADCASTING STATIONS, SATURATING
THE ATMOSPHERE WITH ENERGY, RAISE NEW PROBLEMS**

Even in homes some distance from the tower, fluctuating currents induced in metal objects are powerful enough to vibrate tin roofs or create "singing arcs" between downspouts and the earth.

For those who might be dubious about the attractions of talking waterspouts and singing roofs, there is a compensation. Resourceful residents of Mason have erected special antennas, suitably tuned, to tap a part of the vast flow of energy as it goes by. A number of them have found they can get enough free power by this means to light their homes, and even to run small appliances.

That such huge quantities of radio power can be launched into the air is more than a triumph of science and engineering. It raises the question, perhaps an alarming one, of what will happen as other stations step up their power, and still bigger ones come on the air. If the potent radio waves of superpower stations draw sparks from metal objects, and have enough "kick" to run domestic implements, what effect may they have upon human beings and other living things in their path?

Nowhere, in our daily lives, can we escape these waves that fill the air. They pass unhindered through the walls of our homes and offices, and our own bodies as well. Balloonists have risen miles above the earth and found them virtually undiminished in strength. Scientists have gone to the depths of Mammoth Cave in Kentucky, and picked up radio programs that penetrated 300 feet of solid rock. When radio experts of one great electrical concern wanted to test instruments in surroundings absolutely free from radio waves, the only way they could do it was to shut themselves up in a room completely enclosed in copper screening, with another sheath of galvanized iron screening around that.

What do these waves do to us? For the present, science reassures us, they are harmless. They do not affect people or crops, because they diminish in strength so rapidly as they

radiate from the point of transmission. You may be bombarded by the waves of dozens of powerful stations at once, but the total amount of electrical energy that reaches you is virtually nil. Moreover, the human body would be less affected by the long waves currently used in broadcasting than by very short radio waves, which are definitely known to have a physiological effect.

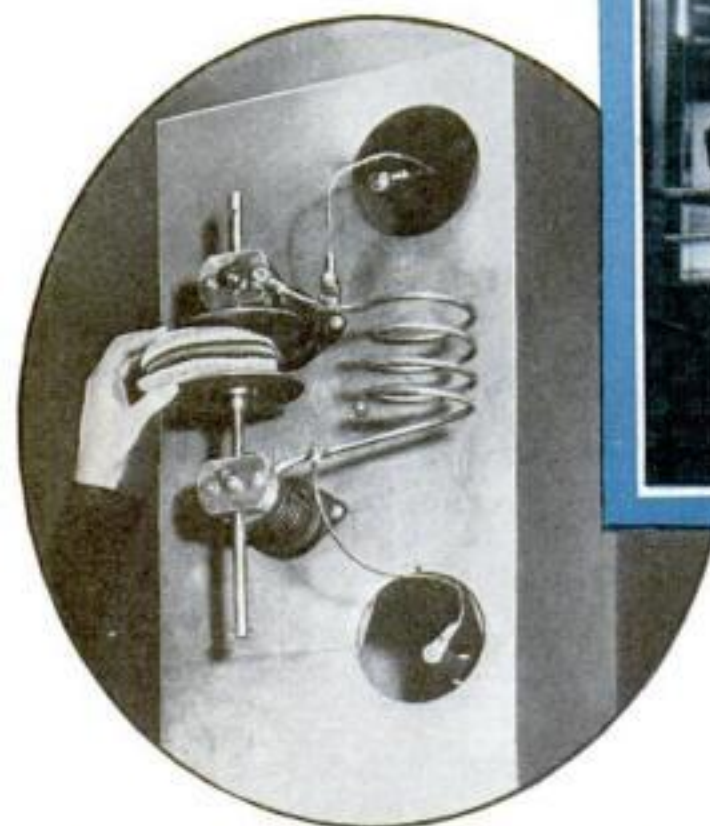
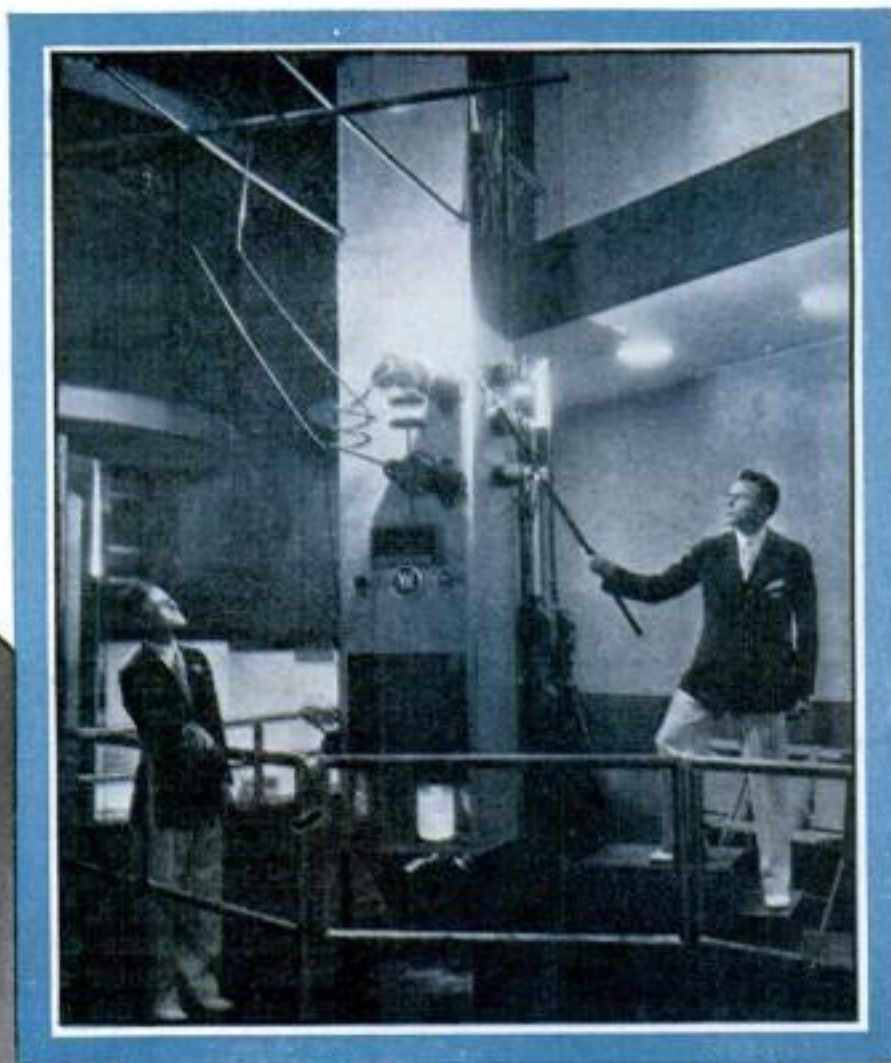
BUT if stations go on increasing their power, and if the trend continues toward shorter waves, the way is opened for all manner of speculation. Suppose, too, that engineers realize the dream of concentrating the energy of huge transmitters into searchlightlike beams to convey electrical power, as well as radio programs, without wires. Will we have to go about shielded in metal armor against the energy pulsing through the ether? Will deadly cross-country beams of radio power transmitters require danger signs and fences along their route, just as high-tension transmission lines now are guarded from the unwary? That science may have to find the answer to such questions, one of these days, is suggested by incidents that have already occurred in radio.

When radio men set up an ultra-powerful short-wave radio tube for test in an eastern lab-

oratory, a few years ago, they found that its waves caused sparks to crackle around the metal grating of the test room, lamps to light, and delicate instruments elsewhere in the building to have the jitters. But the strangest effect was the one least expected. Working around the tube, a number of the men became ill. Some fainted. Investigation showed that although they entered the laboratory in the best of health, they speedily acquired a fever. The short, potent radio waves actually raised the temperature of their blood. From this odd phenomenon was later developed the "radio fever machine" that now is finding extensive use in hospitals, for treating cases in which an artificial fever is beneficial.

Science now knows that the human body behaves exactly like a radio receiving aerial, picking up radio energy of wave lengths to which it is "tuned." Just as the length of an antenna is a factor, so is the height of a person. Calculations indicate a human being of normal height should be most strongly affected by wave lengths in the neighborhood of seven and

Below, experimenting with ultra-short radio waves. Right, the vertical antenna from which WLW hurls its 500,000 watts into the air. In front of the building are spray ponds that help to cool the transmitter tubes



COOKING WITH ULTRA-SHORT WAVES

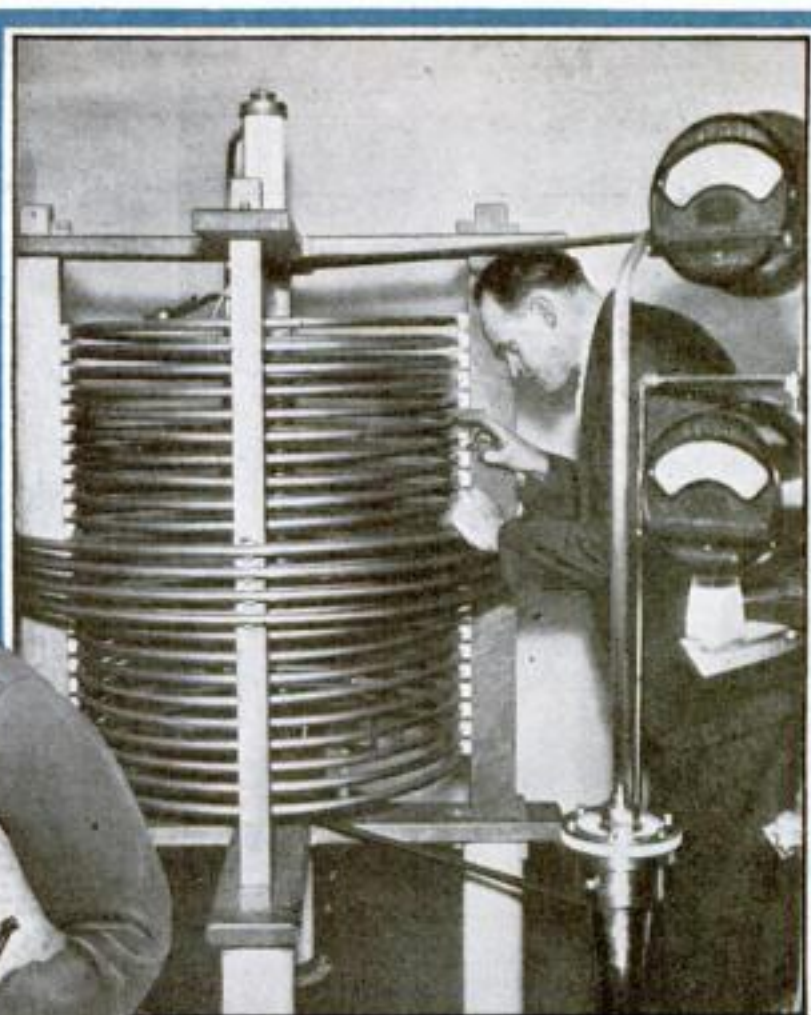
Placed between these two electrodes, a "hot-dog" sandwich was cooked by passing radio waves through it. The action of the current cooked it from the inside outward



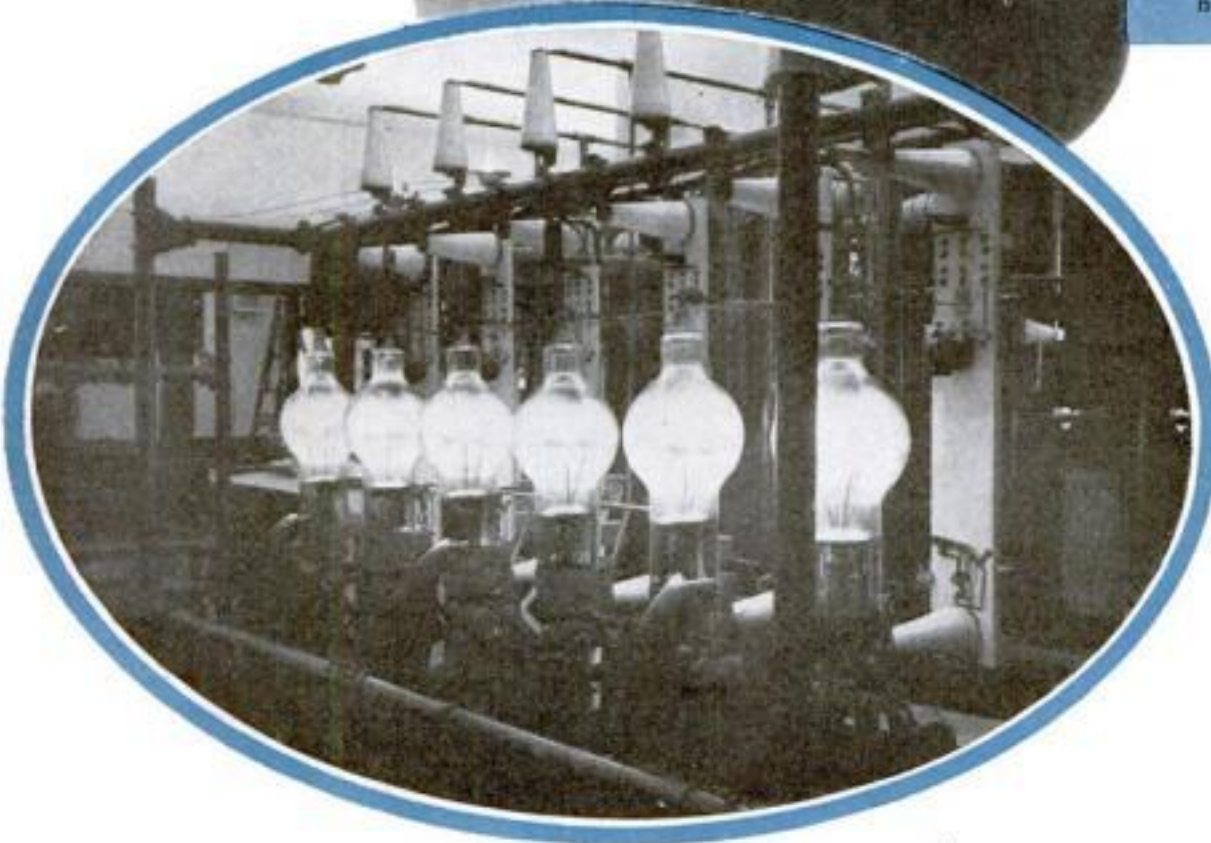


A half million watts on the loose. This photograph shows the arc produced when the full power of WLW was allowed to leap a gap and escape into the earth. All this power normally goes into the air in broadcasting

Do radio waves affect human beings? Below is shown a "radio fever machine" which uses ultra-short waves to create an artificial fever or to warm tissues locally. The waves are passing through the subject's body between the two electrodes she holds under her arms



Mighty coils like this are a part of the equipment that superpowerful radio stations are now using to pump energy into the atmosphere



These 17,000-volt rectifier tubes supply plate current for the transmitter of WOR, Newark, N. J.

a half meters. Observation bears this out, for in actual tests the wave lengths between three and eight meters have shown the most marked physiological influence upon human beings.

Consult the daily radio programs, and you will notice that the wave lengths on which commercial broadcasting stations operate are far higher. That of powerful WLW, for example, is well over 400 meters, or more than fifty times as great. Here, no doubt, is the reason why no discomfort to operators or nearby residents has been reported. Wave lengths ranging down to as short as seven meters, however, are currently employed in experimental transatlantic communication. When experimenters at Schenectady, N. Y., held

a two-way, short-wave conversation with Australia, they experienced synthetic fevers, the temperature of one of them rising more than a degree above normal.

The deadly power of short waves at close range, and in concentrated form, was strikingly demonstrated not long ago by exposing mice to extremely powerful six-meter radiation. In less than ten minutes the mice were dead.

Such short waves have other queer effects. A frankfurter placed between suitable electrodes in the path of radiation from a powerful short-wave transmitter is speedily done to a turn, *from the inside out*. Bread is toasted in half a dozen seconds. A copper bar, lying loose on the floor nearby, becomes so hot that it

cannot be picked up. Experimenters have harnessed this effect to prepare uranium, and other rare metals that are readily attacked by the oxygen of the atmosphere, by melting them in a "vacuum furnace" with radio waves from outside.

Much more, in fact, is known today about the effect of radio waves upon physical objects than upon living things. But tests now under way are fast making up the deficiency, and are uncovering startling facts.

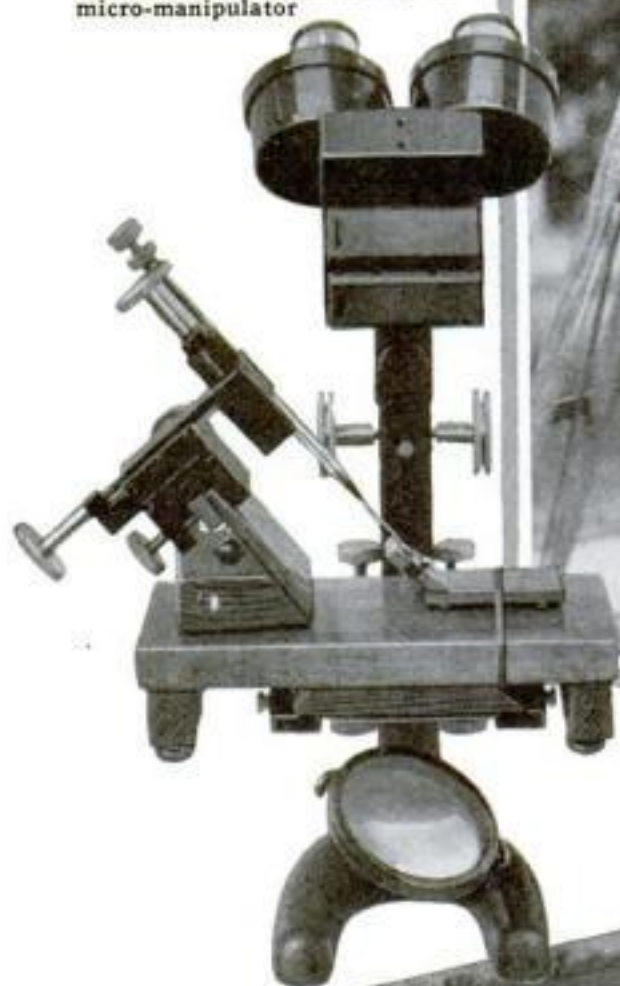
IT HAS even been suggested that the radio waves in the vicinity of a powerful broadcasting station affect a homing pigeon's sense of direction. After many pigeon fanciers had reported poor scores, and lost birds, after the erection of broadcasting stations near their lofts, a Youngstown, Ohio, pigeon breeder carried out a novel test. First he released sixteen birds from the roof of the building of radio station WKBN, in Youngstown, early in the morning when the station was not operating. After a few preliminary circlings, they started off with one accord eastward toward the home lofts. A little later, when the radio station was on the air, the experimenter released sixteen more birds. For nearly half an hour they circled about, apparently unable to find their way, and ended by scattering helter-skelter in all directions. Similar results have just been reported from Nantes, France, where more than a hundred homing pigeons released near a powerful naval radio station apparently lost their sense of direction in the presence of the broadcast waves. Further tests of this kind may, incidentally, shed light at last on the mystery of the ability of homing birds to find their way.

Plants are *(Continued on page 101)*

Amazing Tests Create

By
**George Randall
McCormack**

•
Crossbreeding of the bees is done by means of the instruments shown below: a powerful binocular microscope and a tiny syringe, controlled by a micro-manipulator



Bred for gentleness, these almost stingless bees, in a swarm, allow themselves to be sacked for removal to a standard hive



Sixty unhatched queens are developing in the teethlike cells shown in a brood frame above. Below, worker bees assigned to each queen have begun to build comb and store honey around her. They can be seen engaged in their work



STINGLESS WONDER INSECTS

GIANT bees that can tap new sources of honey are being sought at a strange apiary-laboratory near Vincennes, Ind. Jay Smith, internationally known authority on bees and former expert of the U. S. Department of Agriculture, is carrying on the work. Already, he has developed bees that won't sting, bees that produce more honey, bees that build larger combs, insects that promise to add millions to the agricultural income of the country.

Thirty years ago, Smith started an apiary as a hobby, beginning with a single hive. Today, he has hundreds of swarms and is the foremost producer and exporter of quality queen bees in the United States. Customers in twenty-four nations have bought queens from the Vincennes hives. The bees have crossed deserts on camel caravans, flown down the coast of South America in mail planes and steamed across the Pacific to Japan, Java, and far-away New Zealand. Five full colonies were consigned to the Royal Gardens of the Japanese Emperor in Tokyo.

In addition, Smith is carrying on microscopic experiments which promise to revolutionize an industry as old as civilization itself. Performing delicate operations with precision instruments, he fertilizes queen bees artificially in a fascinating large-scale experiment in scientific breeding.

Not long ago, tests carried on by scientists at the University of California checked up on his progress so far. He and eighteen other breeders submitted swarms to the research workers. The final report showed that Smith's bees produced sixty pounds more honey than the average of the other swarms; that his queens had ten additional egg tubes and that a pound of his big bees contained an average of 263 fewer bees than a pound from other swarms. They ran 200 fewer per pound than the famous Caucasians, long known as the giants of the bee family. Thus, the report showed that the new race of insects emerging from the Indiana apiary are bigger, more efficient, and more prolific than any hitherto known.

"We are interested in developing a larger, more powerful bee," Smith explained during one of my visits to his laboratory, "because larger bees can carry heavier loads and can travel greater distances to search for nectar. Ordinary bees work up to distances of eight and a half miles. I see no reason why we can't breed bees to go twice as far away from the hive.



Into the little box shown above, a queen is being inserted for shipment to Australia. An escort of workers goes with her

New Race of Giant Bees

GREATEST HONEY PRODUCERS

"At present, only the bumblebee has sufficient weight and size to get nectar from red clover. If we can produce honeybees as big as bumblebees, they can work red clover as well as other flowers which have their nectaries beyond the reach of the present insects. Thus, they could tap new sources of honey as well as fly farther afield in their search."

Because of their increased size, many of the insects in Smith's apiary build combs which have thirteen cells to three inches. The usual comb has fifteen.

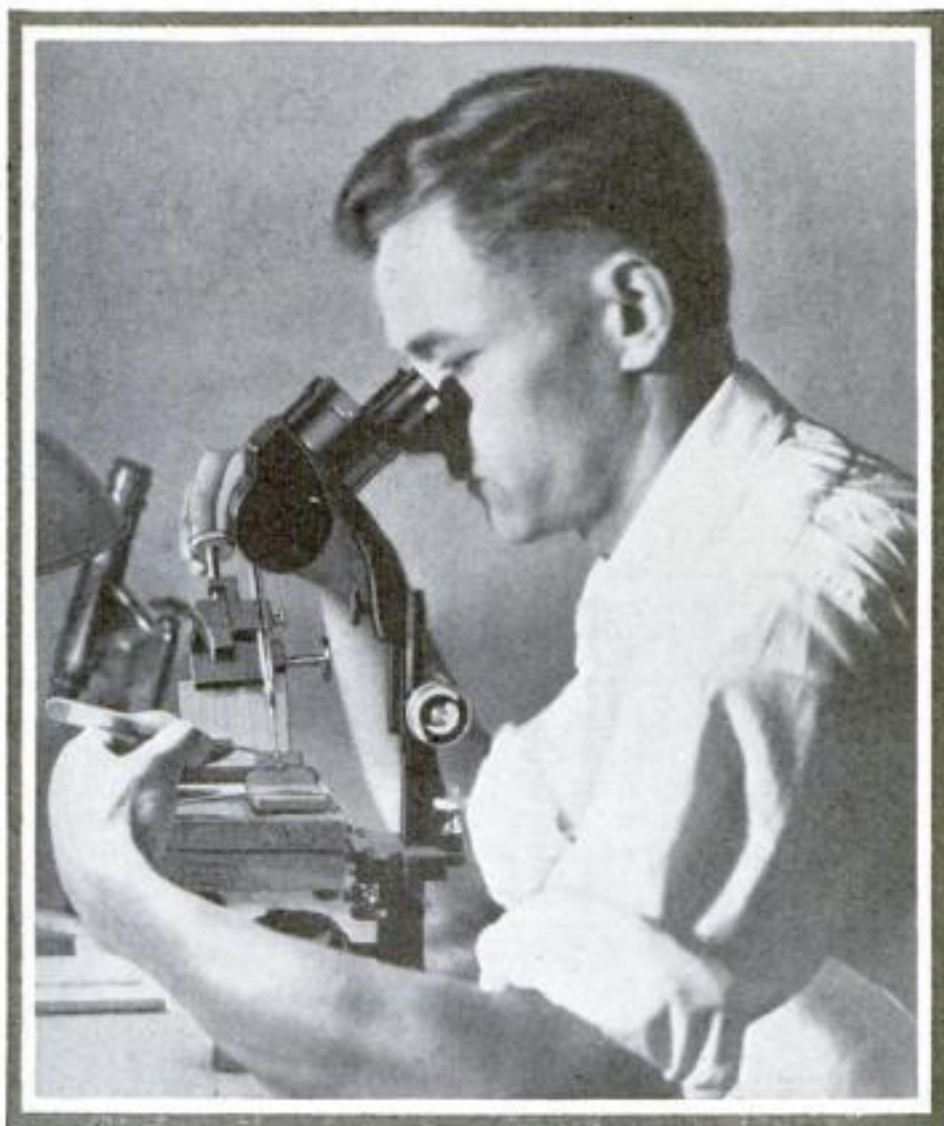
When he started his experiments, Smith used to mate selected queens and drones. Recently, however, he has made more rapid progress by artificial fertilization which eliminates the element of chance in mating.

Working under a powerful binocular microscope with a tiny syringe controlled by a micro-manipulator, he performs his delicate operations. The queen is secured firmly to a tiny table which has been hollowed out to accommodate her body. Then Smith transfers sperm from a selected drone to the sperm sac of the queen.

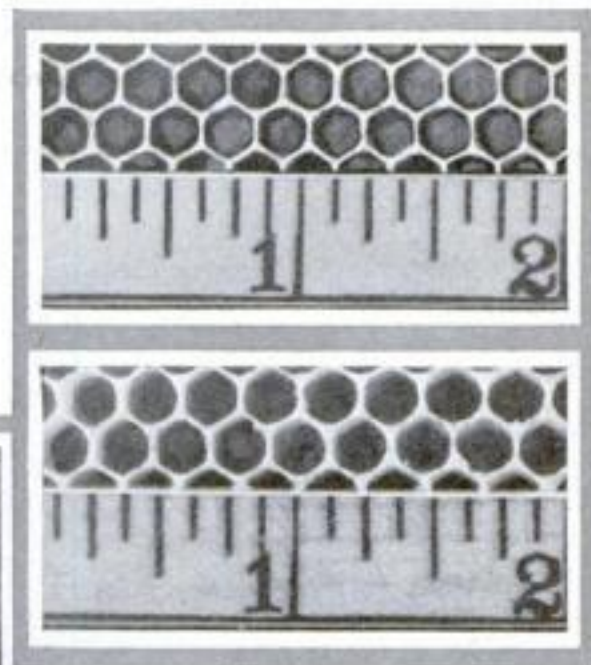
SO FAR as is known, the queen bee is the only living creature that can determine the sex of its offspring. As the queen lays an egg, she fertilizes it with sperm from the sac if she desires to produce a worker. If the egg is not fertilized, it hatches a drone. When artificial fertilization is properly done, the queen begins to lay in a few days.

The number of eggs she produces is amazing. They are deposited at the rate of about six a minute and oftentimes 3,000 are laid in twenty-four hours. Sometimes, the eggs laid in a day weigh more than the queen herself. Workers feed her as she proceeds without stopping.

Because the drone comes from an unfertilized egg and therefore has no father, it inherits only the characteristics of the queen. Thus, mating queens with drones which have hatched from her own eggs produces bees having her characteristics. This makes improving the strain among these insects less difficult than among most other creatures. It also makes it unnecessary to impregnate all the queens artificially. This is done to produce a desired cross. Then the resulting queens are permitted to mate naturally with the drones they produce. The second year, the best queen from all the swarms is fertilized artificially from the



Jay Smith Jr., son of the famous authority on bees, is shown above using the special apparatus to fertilize a queen with the sperm of a drone



Bees are getting bigger at the Jay Smith apiary. The two-inch rule proves that the Smith bees make nine cells where ordinary smaller ones build ten

The method of selecting the best queen of the year. Using a hand magnifying glass, Jay Smith seeks the mother of his next colony among a mass of workers as they crawl about on a comb



best drone. By repeating this process year after year, Smith speeds up the evolution of the kinds of bees he is seeking to develop.

In connection with his scientific researches, he has a number of specially constructed hives designed for observation purposes. They have taught him scores of interesting facts about his bees and their uncanny ability to meet emergencies.

Take one example. Last summer, during the drought in the Middle West, the temperature at Vincennes reached 110 in the shade. This is above the melting point for wax in the comb. Smith watched to see how the bees would protect their stores of honey. All during the heat of the day, he observed the insects bringing water into the hive and allowing it to evaporate. The steady fanning of wings circulated the moistened air and lowered the temperature within the hive.

With a total of 400 swarms at work, Smith lost less than five dollars worth of honey as a result of the heat. The only colony which permitted its combs to drop was one imported from a cold climate where nature had not taught it how to protect its stores.

Another dramatic instance of the swarm uniting to meet an emergency took place when a hive was invaded by tiny red ants. "The ants," Smith relates, "were too small for the bees to sting. I was interested to know (Continued on page 107)



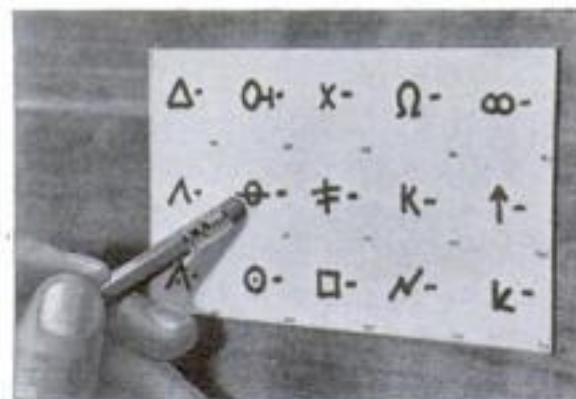
FOOLPROOF TANK DOES NOSE DIVE

MILITARY tanks staged a spectacular demonstration during recent Italian army maneuvers, when a pair of the lumbering steel monsters proved their ability to descend the precipitous embankment shown in the photograph. The cameraman caught

one of the tanks doing a "nose dive" as it skidded to the bottom in precarious equilibrium, almost pitching the men within upon their faces. Low center of gravity of the massive vehicles saved them from toppling, and they stayed right-side-up.

FILE OF LAUNDRY MARKS HELPS TRAP CROOKS

SINCE laundry marks often help to trap crooks and identify amnesia victims, police of New York and other large cities keep on file the symbols and addresses of every establishment. New York City has 12,000 laundries to keep track of, and six large steel files at police headquarters hold their markings. Letter-and-numeral combinations used by large concerns are easy to arrange systematically, but queer hieroglyphics like the ones shown seem to defy classification. Nevertheless, the officer in charge can thumb through his records and find any one in a jiffy, filed according to the predominant feature of the pattern.



Police file card on which characteristic marks of laundries are recorded for identification



GEMS FOUND IN DESERT MYSTIFY SCIENTISTS

STRANGE "jewels" found in the Libyan Desert are described by Dr. L. J. Spencer, gem expert of the British Museum, who has just returned from a trip to the site in an unsuccessful attempt to solve the mystery of their origin. According to one theory, these beads of pale-green glass were formed by the heat of a giant meteorite that fused the desert sand; while another view is that they were brought to earth within a meteorite. The photographs show a mass of the beads in the rough, and a necklace fashioned of them. They have been used extensively for ornaments.



BUMPER GUARDS HEAVY-DUTY AX BLADE

A DOUBLE-DUTY ax, just introduced, is provided with a blade at each end of the head. One blade is intended for cutting roots and branches close to the ground, and a built-in bumper protects its edge from the dulling effect of rocks or gravel. The other blade is employed for ordinary, all-around work in the usual way. Two sizes of the new tool are available. It is now being tested by a state forestry department, with a view to proving its practical value.

TAILOR TAKES MEASURES WITH CAMERA

BY TAKING his customer's photograph, a tailor of Bergen, Norway, dispenses with troublesome and time-consuming measurements. When the patron stands before a scale with measuring tapes adjusted upon him as shown, only a few seconds are needed to obtain two negatives that show all his measurements and details of his posture and appearance as well. Working from the photographs, the tailor finds the method so accurate, it is reported, that a subsequent fitting is seldom necessary.



A customer being measured for a suit by photography. Standing before a scale, with tapes adjusted around him, he poses for two pictures which show all his measurements and the details of his general appearance



RADIO TUBES OF METAL INTRODUCED

RADIO tubes of metal, just introduced in America, are challenging the established position of glass tubes. The new models are less than half the size of glass tubes and are declared to be far less subject to breakage. According to their maker, they show improved electrical characteristics and are particularly advantageous in the field of short-wave reception. Special mounting is required for the tubes, and the first sets employing them are expected to be on the market sometime this summer. The photographs show a conventional glass radio tube compared in size with one of the new metal tubes of similar rating, and a cut-away view of the new metal tube illustrating the interior construction. The metal shell serves as a shield.

NEW CRAFT COMBINES AUTO AND PLANE

AUTOMOBILE and airplane in one is a queer craft under construction for the U. S. Department of Commerce. In flight the machine will resemble an autogiro of standard design. When it alights, however, the blades of the "windmill" fold back and the

machine will then run along a highway under its own power, transferred from the motor through special gearing to the wheels. Thus an owner may enter his machine, and drive along the streets to the nearest suitable field for a take-off.



Planes parked at doorsteps may become common if a new combination machine proves a success

Five-Layer Film Makes Home Movies in Color

A NATURAL-COLOR film that fits amateur cameras and projectors of standard sixteen-millimeter size now permits home movie makers to take color pictures of professional quality. No special filters or other auxiliary devices are required. Pictures may be taken indoors or outdoors, exactly as in black-and-white photography; the only difference whatever, as far as the picture maker is concerned, is that a slightly larger stop—F/8 instead of F/11, for example—is used to admit more light.

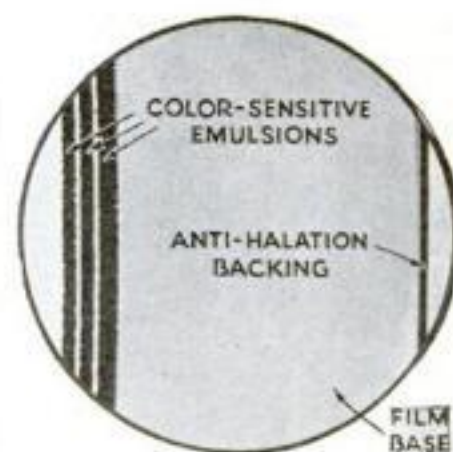
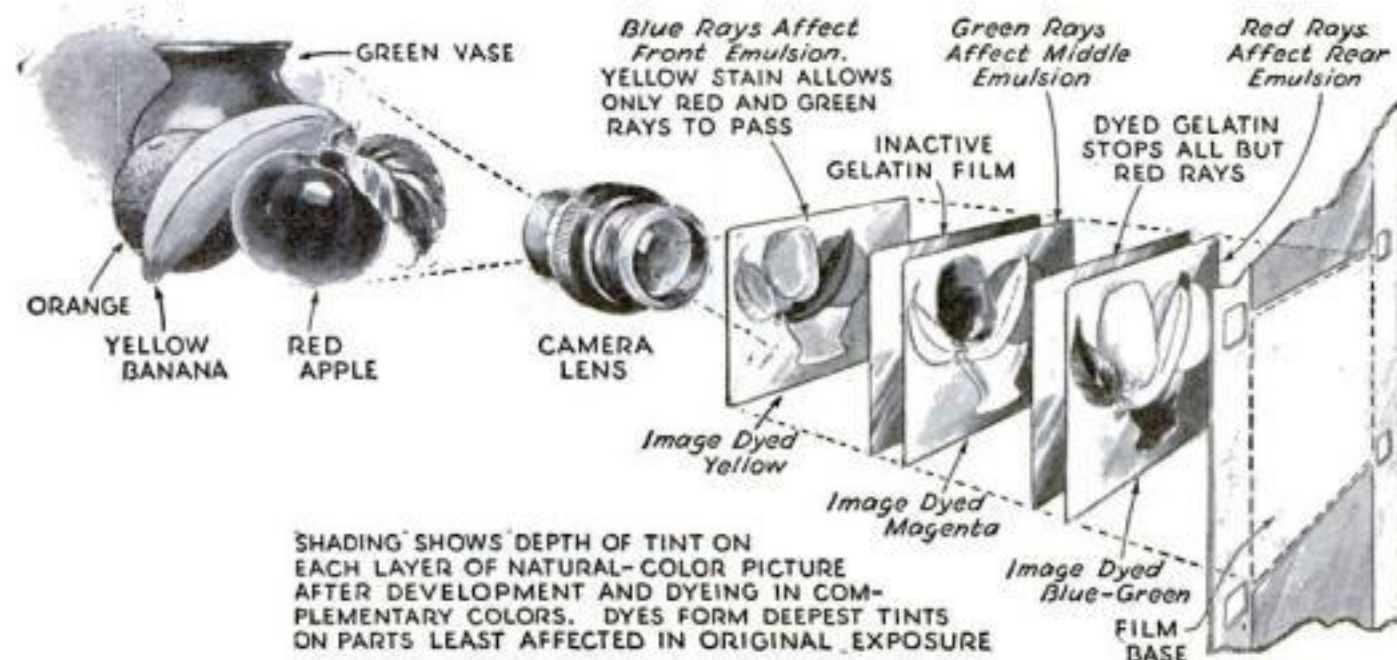
To separate the various hues in a scene, other single-film processes resort to such devices as color gratings, prismatic ridges, or microscopic tinted grains on the surface of the emulsion. The new film dispenses

with all these, and can be magnified indefinitely without the appearance of grains or streaks. So translucent are the images obtained, that a low-power projector is adequate to give brilliant, glowing colors.

A "sandwich" of five gossamer-thin layers, with a combined thickness hardly greater than that of a standard emulsion, constitutes the coating of the new film. The layers include an emulsion sensitive to blue light only, with which is incorporated a yellow stain to serve as a color filter; a separating layer of gelatin for mechanical purposes; a green-sensitive emulsion; a dyed gelatin color filter; and a red-sensitive emulsion. How the three emulsions register the three primary colors of the subject

and combine them in single natural-color pictures is shown in the diagram.

Applying so thin a sandwich of layers to a film is a feat in itself, but even more remarkable is the method of dyeing up the images in their proper colors. Sent to the manufacturer for finishing, the film is run through a series of intricate and delicate chemical processes that dye the front, middle, and rear images of each "frame" selectively. Each image receives its own color, and no dye strays, despite the microscopic distances that separate one layer from another. The final treatment removes all traces of the original silver images produced by development, leaving the natural-color picture in the transparent dyes.



Drawing at left shows how the new color film works. The five layers are combined in a thin coating. Above, magnified cross section of film showing emulsion layers contrasted with film base

RACING CAMELS LEAP HURDLES



BY TRAINING camels to leap hurdles, police officers of Cairo, Egypt, have added new thrills to the exciting sport of steeple-chasing. Natives gather at each side of the barrier, and wave arms and sticks as the animal approaches, to discourage it

from running around to the side. The striking picture reproduced here shows one going over a jump, in a trial of its ability. Despite its ungainly appearance, the camel makes a fleet steed. Bodies of "camel cavalry" have been used in desert warfare.



FOOT GRIPS OF METAL FOR MAKING STILTS



ANY BOY may build his own stilts, without nails, bolts, or screws, by using a pair of inexpensive stilt steps recently placed on the market. A few blows of a hammer, as illustrated, and these metal cleats are firmly wedged upon any standard, dressed, one-by-two-inch pine lumber such as may be found in the home or bought for a few cents.



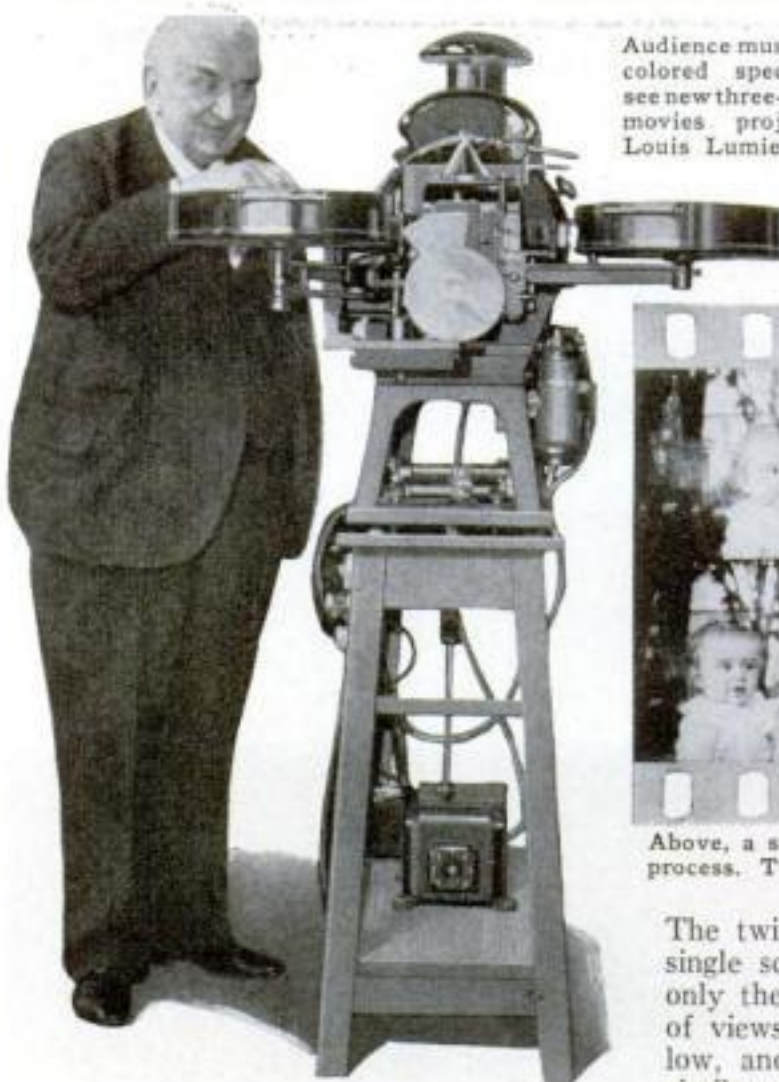
KNITS ROPE BUMPERS TO PROTECT SIDES OF SHIPS

KNITTING on a grand scale earns a livelihood for one San Francisco craftsman. Making ships' bumpers is his unusual vocation, with stout rope as his material and a strong wooden peg as his weaving tool. The products of his handiwork are hung overside from big liners when they dock, or when smaller vessels pull alongside, to protect the vessels from being scraped. A typical rope bumper is shown near completion in the photograph.

INSECT ARMY STARTS WAR

MORE than 67,000 insect enemies of the corn borer, representing sixteen species, have been liberated in Suffolk County, Long Island, N. Y., to fight the pest. Some of the parasites employed come from Europe, others from the Orient.

DEPTH MOVIES MADE MORE REALISTIC



Audience must use these colored spectacles to see new three-dimension movies projected by Louis Lumiere, at left



Above, a strip of stereoscopic film used in new process. Twin lenses throw pictures onto screen

The twin film is then projected upon a single screen. So that each eye will see only the picture intended for it, one set of views is dyed blue and the other yellow, and a pair of tinted spectacles in similar colors is worn by the viewer to "unscramble" the superimposed images. A black-and-white picture with lifelike depth is seen as a result. The new part of the process is not the principle, which has been applied for many years, but the special dye formulas used. Delicate laboratory tests show that these formulas yield colors that cause a minimum of eye fatigue.

ROCKET CARRIES AID IN OCEAN RESCUES

RIDING a rocket, a compact, inflated suit designed by a British inventor, will save lives at sea. It can be fired to persons in water from the beach or from the deck of a ship, the distance it travels through the air being determined by the angle at which the projectile is shot into the air. In addition to the suit, which is carried in a small net, as shown below, the rocket hauls a light life line to the person in distress. Recent tests of the novel rescue device carried on at Southend, England, are reported to have been entirely satisfactory.



HORSELESS SULKY RUNS ON TWO WHEELS

INVENTED by an Italian engineer, a queer "horseless sulky" has been rolling on the roads near Brussels, Belgium, in recent tests. The seats, engine, and controls are located between the two huge, rubber-tired wheels. According to the designer, the vehicle can attain speeds of 116 miles an hour.

BICYCLIST SEEKS NEW SPEED RECORD



In the photograph at the left, Frank Bartell is seen riding his bicycle behind a streamlined windbreak mounted on an automobile. Below, his high-g geared sprocket



ONE HUNDRED miles an hour on a bicycle! That is the speed Frank Bartell, present holder of the world's straightaway speed record, thinks is possible. Streaking down a California boulevard behind an automobile equipped with a streamlined windbreak, he recently covered a mile at the rate of 80.85 miles an hour. His racing cycle has a special steel-disk sprocket with a gear ratio of forty to six. Tape, wound around the tires and rims at intervals, kept the tires from peeling off under the terrific strain.



ARTIFICIAL LARYNX ELECTRIFIED

BY PLACING a small tube attached to a new electric larynx between his lips, a person who has lost the use of his vocal cords may converse in natural fashion. The tube conveys the tone of an electrically vibrated reed to the mouth, where the sound is modulated by the lips and tongue. Instruments have been designed with a bass tone for men, and with a soprano tone for women. Engineers of the Bell Telephone Laboratories, who developed the new device, consider it a marked advance over earlier forms in which the reed was vibrated by air pressure from the lungs or from hand-operated bellows. (P.S.M., Apr., '33, p. 34).



FLAG TO MARK CULTURAL CENTERS IN WAR TIME

TO PROTECT art and scientific centers in wartime, as the Red Cross banner does hospitals and medical centers, Nicholas K. Roerich, founder of the Roerich Museum of New York City, has designed a new flag for international distribution. Three purple disks within a purple circle on a white background form the design of the three-foot by five-foot banners. The League of Nations has indorsed the idea and flags are being distributed to universities, libraries, cathedrals, and museums throughout the civilized world.

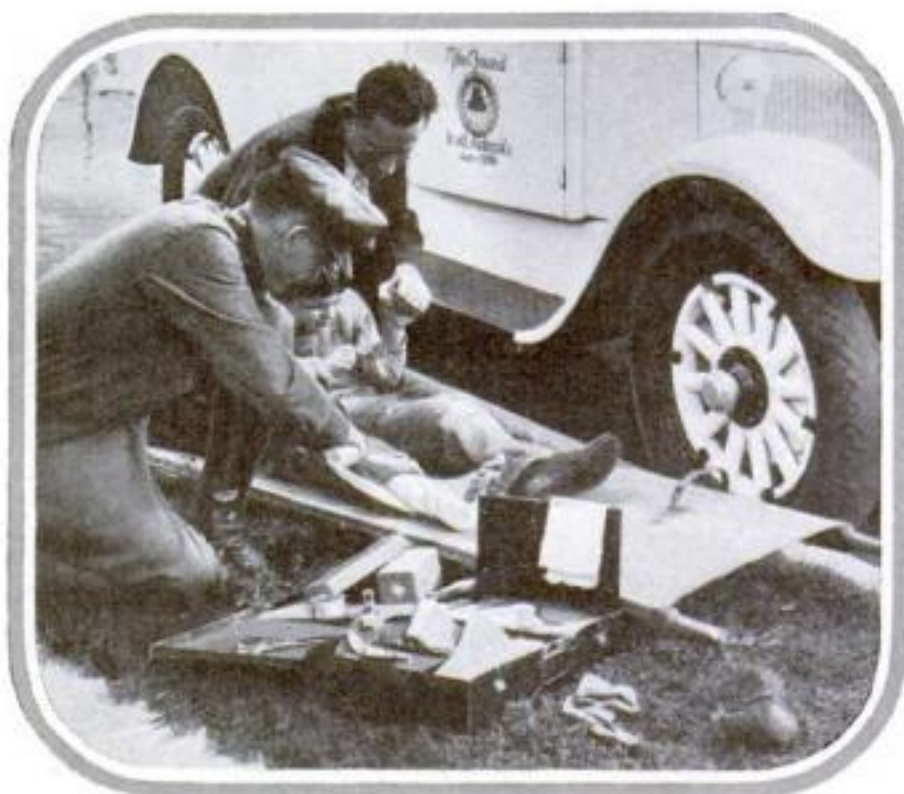
FEED CATTLE POTATOES

THE use of potatoes as a substitute for hay in feeding cattle has been proposed by agricultural experts at Cornell University.

My Ten Years with the HIGHWAY PATROL...



Good Samaritans of the Road



By
**BILL
ELLIS**

Emergency assistance
by the highway patrol.
At top, putting out an
auto fire. At left,
giving first-aid treat-
ment to the victim of
an accident. The white
trucks are friends in
need to all motorists

court of a brown building in Los Angeles, Calif., and joins the stream of traffic. They are the highway patrol cars of the Automobile Club of Southern California. Ten years ago they were put on the road, with drivers who had been instructed simply to go looking for motorists in trouble. Since that time I have piloted one of the white patrol trucks more than a million miles over the highway.

I have driven miles through weather so thick I could see ahead no farther than my radiator cap. With coat collar turned high, I have driven into windstorms when my truck, the top speed of which is fifty-five miles an hour, could crawl no faster than twenty; when pebbles as large as peas whirled through the air, and gravel, rattling like shot against the car, would soon have taken the skin off hands and face. I have climbed over the "ridge" when fog froze on the windshield and six-inch icicles hung from the visor. Other times, in glorious weather, I have seen panoramas of inexpressible loveliness unfolding constantly.

As we travel through sparsely settled regions, wild animals often dart across our path—deer, coyotes, foxes, raccoons, and many other kinds of small game. Not long ago, an out-of-town patrolman wrote

A COUGHING, sputtering airplane nosed down heavily into a bean field and bumped crazily over the ground. Flames burst from the engine, and licked along the fuselage.

On the near-by highway, the driver of a white truck jammed on its brakes, leaped out, and raced toward the burning plane, fire extinguisher in hand. A moment later, he had quenched the flames and was administering first aid to the pilot, who

had suffered burns in the forced landing.

A few hours later, a similar truck drew up in front of a sheriff's substation. Two men got out, then the driver, whose hand stayed in his ominously bulging coat-pocket. They were auto thieves he had captured on the road. The "gun" with which he had bluffed them was an old tobacco can!

Every morning, rain or shine, a fleet of trim white trucks moves out of the inner

the supply office somewhat as follows: "Please send me a new broom. I used the one I had to sweep a dead skunk off the highway."

Every morning, before I leave, I check over the list of supplies my truck must carry. There are hand tools to use in making emergency roadside repairs; a supply of gasoline and oil to be sold at cost to stranded motorists; a tow rope, a stretcher, and a full first-aid kit, including splints, bandages, tape, lotions for burns, and other medicines. There is a compressed-air tank with a long hose, used to inflate tires and to blow out plugged gas lines. Then there are warning and detour signs and repair parts for damaged flasher signals.

Each day, as I leave the office, the official police "hot sheet" list of stolen cars is handed to me, to be clipped on the dash. More than sixty times I have tailed "hot" cars until I could point them out to a law-enforcement officer. The other day, after helping two men change a tire, I reached into my truck for a service card for the men to sign. Meanwhile, I checked their license number against the "hot sheet." They were driving a stolen car.

While the men signed, I said, casually, "By the way. How is it that you driving Mr. Smith's car?"

The men tried to bluff, but their excuses

were unconvincing. I held them there while a passing motorist informed the sheriff.

Another man on patrol in the desert saw an abandoned car standing by the roadside. The radiator was cold, the gas tank empty. From the next town he telephoned the owner, and found that the car had been stolen. Then he led sheriff's men back along the road until they picked up two young men, who had stolen not only the car, but also a number of valuable musical instruments.

STATISTICIANS say motorists may expect one death and thirty injuries in every million miles of driving, but since the "Good Samaritan" patrol was started, our white cars have traveled more than 4,000,000 miles without major mishap, rendering service to approximately 150,000 motorists in trouble. During this time we made minor mechanical road repairs on 25,410 cars, and towed 7,320 others to nearby garages; gave tire service to 7,266; sold 5,000 gallons of gasoline and 832 quarts of oil to stranded drivers, and gave emergency assistance to 2,150 persons injured in accidents.

We also swept twenty-five tons of glass, nails, and debris from the highway; distributed 9,257 maps, erected 13,485 detour signs at danger points, reported 3,009

damaged road signs, and repaired 2,060 flasher-type warnings; recovered 305 stolen cars, found 1,455 lost articles, answered 62,166 requests for information, and directed traffic in 4,364 emergencies.

Driving at an average speed of thirty miles an hour, we roll up a total of more than 1,000 miles a day. During bad weather, we report changing road conditions by telephone two to four times a day. This information is relayed through the touring bureau to

all branch offices, so motorists anywhere may obtain up-to-the-minute road information.

Anything that can be done to make driving safer is our duty. If the road is washed out or has become hazardous, a warning or detour sign must be erected. Protruding nails in wooden bridges must be driven down, and broken glass cleaned up. In the course of my career I have swept up more glass than my truck could haul away.

Not only glass, but oil, apples, and even milk are occasionally spilled upon the highway. One sensational collision splintered a truck loaded with 100 cases of eggs! So slick was the pavement that traffic had to be detoured while I shoveled sand over the giant omelet.

As part of our work we try to keep a guardian eye on other motorists' autos. If a car's wheels are badly out of line, we call the driver's attention to them. Loose steering gear, leaking gasoline tanks, and badly adjusted brakes thus are often brought to notice in time to prevent casualties. One patrolman stopped the chauffeur of a high-priced car near the top of a steep grade and called his attention to the rear wheel. Because a tire had been cut, the tube protruded in a great balloon. Under the strain of curves on the down-grade ahead, this tube would have blown out, and, probably, caused a serious accident. Our men are alert.

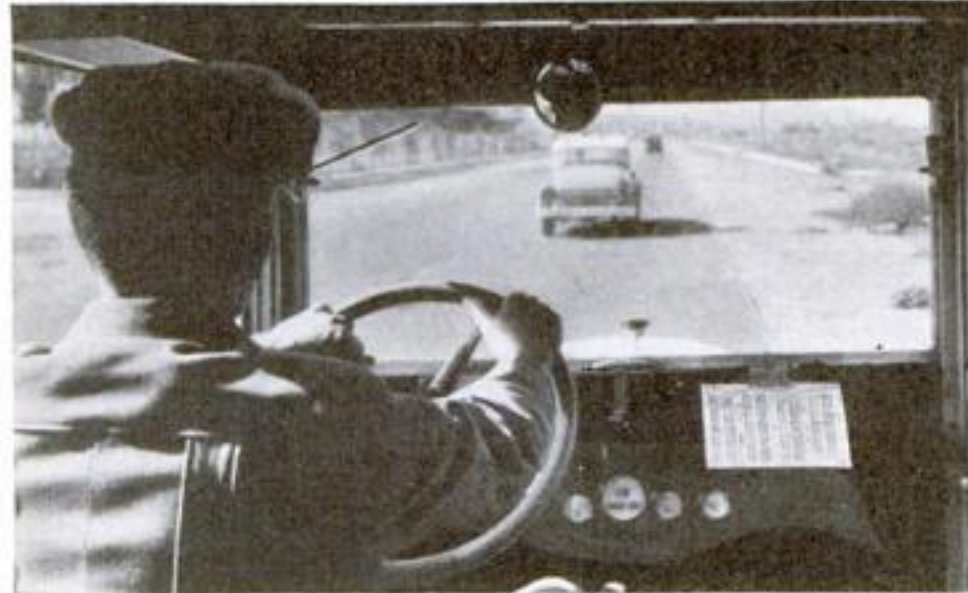
Each man is a graduate of a first-aid course at a Los Angeles receiving hospital, and carries his kit at all times. The occasions for use of it occur frequently. A patrolman found a bank messenger lying near death after his motor cycle had plunged over a twenty-five-foot embankment. Quickly he applied first-aid treatment that stopped a heavy flow of blood. His action

(Continued on page 110)



GASOLINE. One of the services of the highway patrol is to supply gas and oil at cost to stranded motorists. Above we have the patrolman replenishing a tank

STOLEN CARS On the dash of the patrol car at the right is the "hot sheet" listing cars reported as stolen. As he cruises over the highways, the driver checks the license numbers of all the automobiles he meets or passes



SIGNS. In the photograph above, the patrolman is erecting a temporary sign to mark a detour for road construction. Washouts and other highway dangers are discovered, and warning signals erected. In bad weather, reports of changing road conditions are telephoned to the headquarters of the organization and there made public

Sulphur

MINED BY

Blasting

IN WORLD'S
BIGGEST DEPOSIT



This pile contains 100,000 tons of almost pure sulphur. At left, a worker in the Leviathan Mine removing sulphur ore with pick and shovel, the same method that is used in mining metals



taking sulphur from the earth have been worked out by chemists and engineers, notably the hot-water technique in which superheated liquid is pumped into the earth to melt the sulphur and bring it to the surface. The Leviathan Mine, however, is the first to blast out the brimstone. Because it ignites

at low temperatures, sulphur ordinarily would burn during an explosion. In the California mine, however, the volcanic ash acts as a fire extinguisher.

Rolling from the mine, ore-laden cars enter huge steel retorts. Live steam, shooting into the sealed containers, melts the sulphur away from the ore. Through gratings which form the bottoms of the cars, the molten brimstone flows onto the floor and hardens in wooden bins. As soon as it is broken up into chunks, it is ready for market. This single operation produces sulphur that is 99.88 per cent pure.

Vital to a host of manufacturing processes, ranging from the making of explosives to the production of moving pictures, sulphur finds new uses each year. The United States, through advanced scientific recovery methods, produces more sulphur than all other countries of the world combined. With its rich deposits being blasted from the ground, the Leviathan Mine promises to help maintain this leadership.

ESTIMATED by engineers to contain 200,000,000 tons of sulphur-bearing ore, the largest deposit of brimstone ever found has been opened to mining operations in the mountains of California, forty miles southeast of Lake Tahoe. The sulphur-ore formation extends for a mile and a half and is half a mile wide. In the area now being mined, the "vein" is 110 feet thick.

Unlike sulphur-mining operations elsewhere in the world, ore from the new Leviathan Mine is being removed by the same method employed to take metals from the earth—blasting with powder. Since four tons of pure sulphur are refined from every ten tons of ore, the vast deposit promises to yield at least 80,000,000 tons of sulphur—enough to supply present demands of the United States for fifty years or longer.

Miners, working the property for copper in 1868, first discovered the sulphur. No survey was made then and the mine later was abandoned. In 1931, a company was formed to explore the deposit. Recently, its vast extent was announced by John Hays Hammond, internationally known mining engineer. Already fifty miners are engaged in removing ore from two tunnels and reducing it to pure lump sulphur.

In the past, several novel methods of



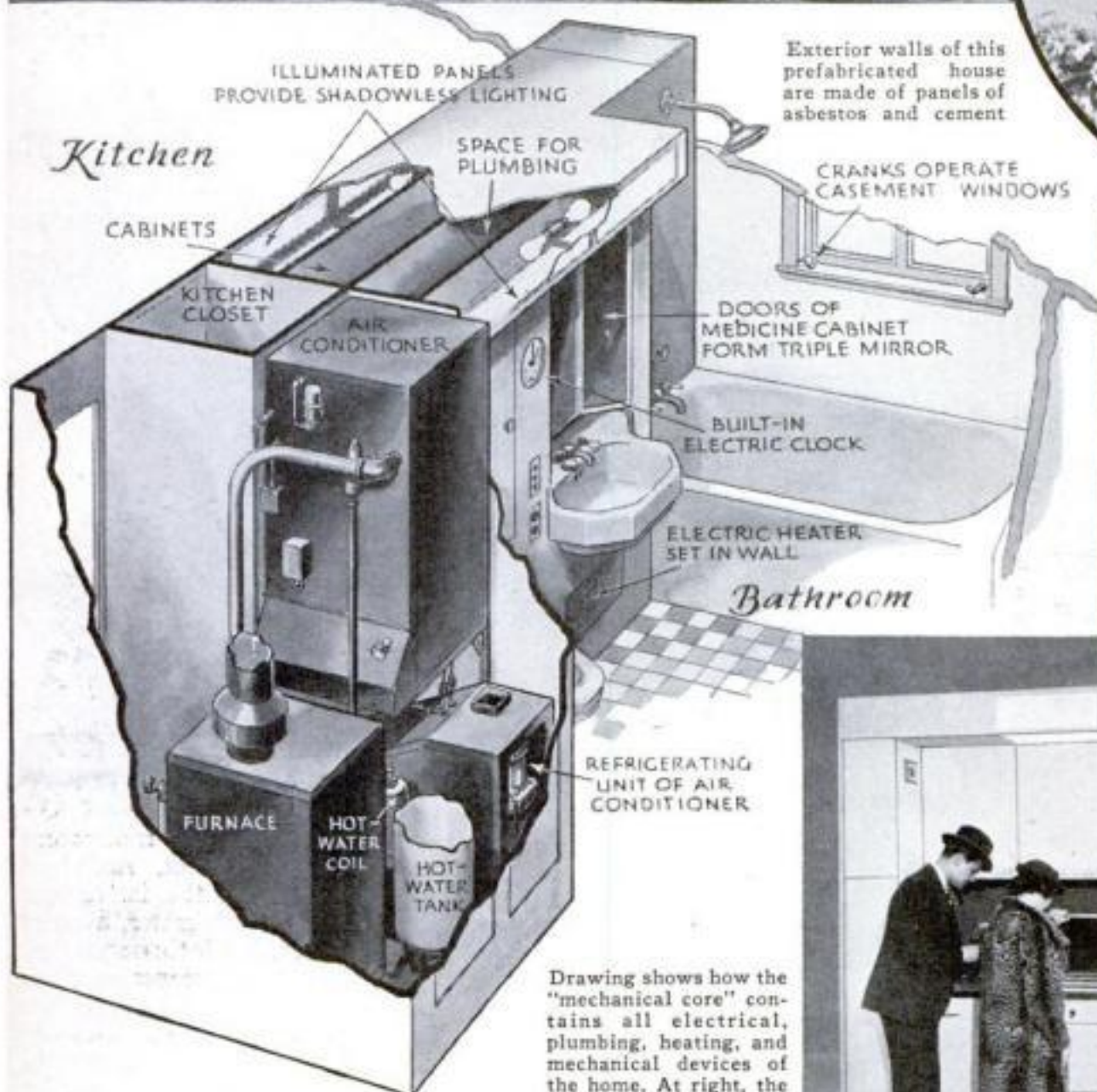
A block of rock impregnated with sulphur, which will be removed by melting it with steam. Below, the buildings of the Leviathan Mine as seen from above. The tunnel-like shed leads into one of the mine entrances



Complete Home Is Factory-Built



In circle, the radio set and electric clock built into the living-room wall. Tubes may be replaced from the back. Center picture shows one of the ducts of the air-conditioning system



Drawing shows how the "mechanical core" contains all electrical, plumbing, heating, and mechanical devices of the home. At right, the kitchen side of the unit, containing the refrigerator, sink, dish washer, and stove



SOON to be placed on the market, a factory-built home recently exhibited in New York City offers refinements and mechanical innovations never before available.

Select the model you prefer, in a showroom, and a huge truck will deliver it in sections to your lot, ready to be assembled. Four-foot panels of asbestos and cement are speedily joined upon a frame of steel to form exterior walls that are fireproof, soundproof, and insulated against heat and cold.

An entirely new invention, a "mechanical core" at the center of the house, combines all its plumbing, heating, electrical, and mechanical devices in a single compact unit. One side of the mechanical

core forms a wall of the kitchen; the other, a wall of the bathroom. In two-story models, the core extends to the second floor.

On the kitchen side of the motorized unit are an electric refrigerator, sink, electric dish washer, and stove; the latter operates on gas or electricity as desired. The bathroom side provides an electric heater that blows in warm air on chilly mornings, and convenient electric outlets. Both kitchen and bath have shadowless lighting and built-in electric clocks.

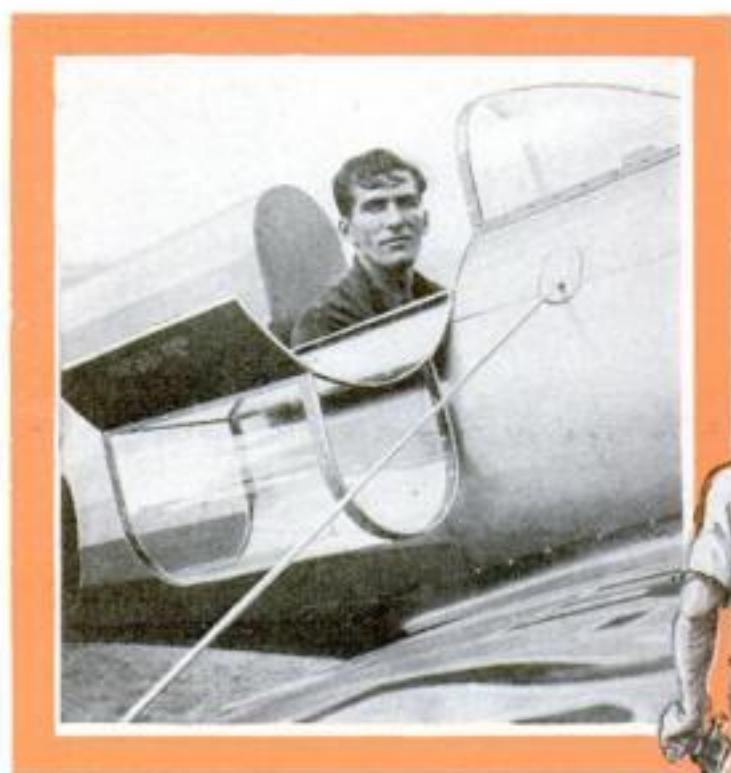
The mechanical core also contains a

furnace, operating on either coal, gas, oil, or electricity. An air conditioner delivers purified air, warmed in winter and cooled in summer, through ducts to the rooms of the house.

Even in its smallest details, the new house shows the result of scientific engineering. Casement windows open and shut at the turn of a small crank. A bridge lamp, when the shade is turned upward, automatically snaps on a more powerful light for indirect illumination. Tubes in the built-in radio can be replaced through an opening in the other side of the wall.

4 Miles a Minute

IN A FLYING BABY BUGGY



The author in the tailored-to-fit cockpit of his tiny plane. Note hinged, transparent cover



Rounding a pylon, the tiny planes bank into a rocketing, 200-mile-an-hour vertical turn

ON SIXTEEN-FOOT wings, we were ripping through the air at 220 miles an hour.

Three of us were bunched on the Cleveland back-stretch, fighting for the lead during the 1934 Air Races. So tiny was my cockpit that I had no room for even a parachute, and so small were the racing ships we flew that reporters referred to our speed battle as "the race of the baby buggies."

Nearing the pylon, we banked into a rocketing, 200-mile-an-hour, vertical turn. Barely thirty feet beneath my lower wing-tip, the ground was a dizzying blur. Suddenly, I saw one of the other pilots dive between me and the pylon, going into the turn too fast for his wings to hold. They mushed through the air, carrying his plane almost into the path of my steel propeller.

It was all over in a wink. I kicked right rudder and rocked the stick in the same direction. My speed was so great that the move literally jerked the plane sidewise 500 feet into the air. A moment later, I was diving again with engine wide open, in an effort to make up lost ground.

It is such thrills as this that keep the racing pilot on his toes. In jockeying my

By LEE MILES

742-pound baby buggy into the money in forty-seven races at meets from coast to coast, I have had my share of high-pressure excitement. I have been flipped upside down at 200 miles an hour. I have had a tire explode in a mile-a-minute landing. I have seen a rival's ship tear to pieces in the air almost under my nose. I have come down for dead-stick landings in mosquito ships that touch earth at nearly 100 miles an hour.

My little racer, designed by Leon Atwood and myself, measures only sixteen feet from wing tip to wing tip. It is the fastest plane of its type in the world. It will outclimb the swiftest pursuit ship, zooming to an altitude of 10,000 feet in two minutes and ten seconds. Officials have clocked it at 233 miles an hour. I am sure I have broken the 240 mark in straightaway sprints.

Imagine yourself in the cockpit of such a baby racer. The plane is "tailored to fit." There is no room for a parachute, and

your head almost touches the transparent hood that covers the cockpit. Ahead of you are a few dials on the instrument panel, a tachometer, an altimeter, a speed indicator, a cylinder-head thermocouple, and oil-pressure and oil-temperature indicators. Superchargers boost the power of the inverted, four-cylinder, air-cooled Menasco motor in a race. Our racing ships are classified according to the cylinder capacity of the engines. Mine is in the 375-cubic-inch class. More than a dozen times, it has outdistanced speed-planes of twice its power.

To reduce friction to the lowest possible point, both the wings and the fuselage are waxed to a high gloss. Bracing wires end in "buried" fittings within the wings, and an additional layer of fabric gives strength and smoother contour to the leading edges. Although the wings have to withstand tremendous pressures, they are only three and a half inches thick at their strongest point, along the front spars. From here, they taper back to the trailing edges where they are but one eighth of an inch thick.

It is along these edges and on the ailerons that pressures build up rapidly at high speeds. They are the danger points.

*Hair-Breadth Escapes
of the Pilots of Midget
Racing Planes, as Told by
One of the Veterans of
This Perilous Sport*



Art Chester, one of the leading small-plane pilots, poses beside his racer to show its diminutive size

Aileron flutter is probably the thing a racing pilot dreads most, for the vibration will quickly transmit itself to the whole wing with such force it may tear it apart. Rough air increases the menace.

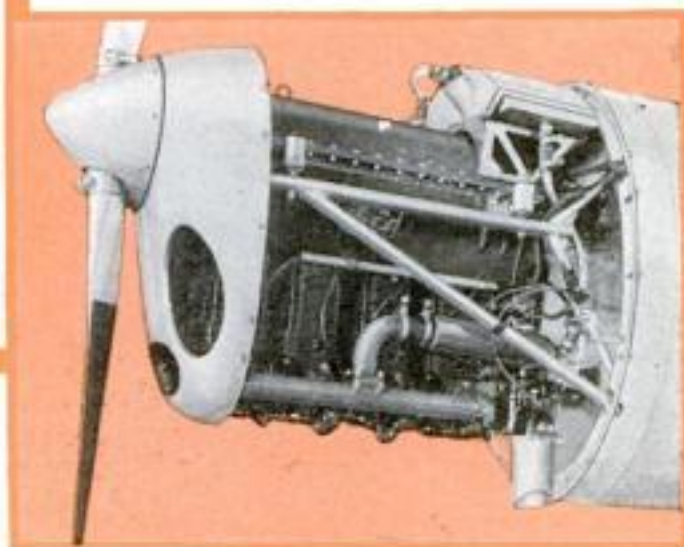
I remember the day, last summer, when "Doug" Davis was killed at Cleveland. The air was boiling. Fearful of dancing ailerons, I was flying the race far higher than usual, probably at a height of 100 feet above the ground. I had throttled down to fifteen miles below my top speed. Davis, in a larger ship, was just ahead of me. Bouncing along at 200 miles an hour, I saw one aileron and the whole trailing edge of his wing suddenly fly into space as though blasted loose. Davis knew what had happened and pulled straight up into the sky. But, before he could fight his way free, the ship fell out of control and carried him to his death.

Undoubtedly, racing in 200-mile-an-hour "baby buggies" ranks as one of the most hazardous sports in the world. Yet, most of the fatalities in air racing have occurred in the bigger, higher-powered planes. So far, only one pilot, Roy Liggett, has been killed in a midget speed-ship. And his death did not occur during a race, but in a qualifying run.

Usually, I am so busy tuning up my plane that I don't watch other pilots in the air. But something caused me to keep my eyes on Roy during his qualifying run at Chicago. He was flying at tremendous speed low over the field. Suddenly, as though some unseen hand had reached up and twisted the ship, it somersaulted and buried itself in the ground.

Strangely, I am never nervous in the air. When I'm clipping the tree-tops at nearly four miles a minute, my mind is serene. At the starting line, however, my stomach rolls itself into a knot. Roy Minor, Art Chester, Gordon Israel, and the other pilots tell me they feel the same way. When the starter's flag drops, our planes start to move, and we relax, and concentrate on winning.

We get away in a race-horse start,



The engine of the author's plane, a four-cylinder inverted Menasco

Lee Miles ready for a take-off. Note the plane's streamlining and sturdy external bracing



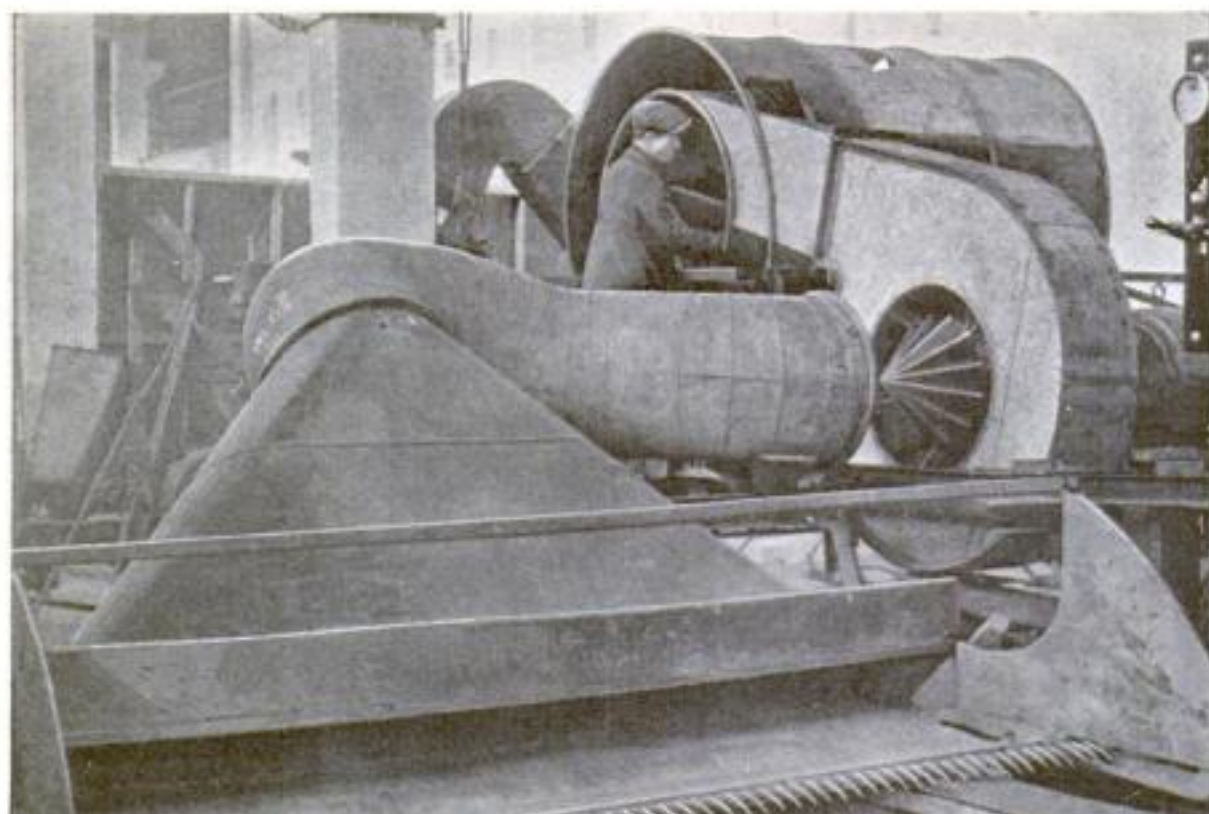
The start of a race. Assistants hold the ship back until the starting flag drops, then let go



Leon Atwood, codesigner of the author's plane, exhibits a pair of tiny wings for "baby buggies"

as many as eight of the tiny planes starting to roll at once. Handling the tricky little ships on the ground is a delicate job until they attain high speed. Yet, not long ago, I made a ninety-mile-an-hour take-off from a concrete highway in California. In spite of a cross wind, the plane stuck to the smooth runway and at the end of an 800-foot dash, I eased the stick back, the wings caught, and I soared away.

Last year, at a meet in the East, eight of us were gunning our motors on the take-off when something we all dread happened. Out of the tail of my eye I saw a near-by plane veer, swerve out of its lane and rush head-on *(Continued on page 113)*



BIG VACUUM CLEANER HARVESTS GRAIN

RESEMBLING a giant vacuum cleaner, the pneumatic combine shown above has been developed in Russia for harvesting wheat and rye. Just as a household cleaner lifts dust from a floor, the powerful suction of the new machine picks up the

grains from the header and hurls them into a capacious hopper. The suction also serves to lift the crops into the header, making the usual revolving rake unnecessary. If tests prove successful, mass production of the machines may be undertaken.

MEMORY MACHINE KEEPS WATCH FOR STOLEN AUTOMOBILES

TO TRAP automobile thieves, a new "remembering machine" has been devised by a California man for use in booths at bridge entrances and similar strategic points. Patterns are punched out, recording the license numbers of cars reported stolen, and are placed in this machine. The attendant then taps out the license number of each passing car on the eight-rowed keyboard of the machine. If one of the numbers is that of a stolen car, a bell rings and a lamp lights, permitting a warning to be flashed to the other end of the bridge to stop the car. The machine may also be used for other tasks that would tax human memory.



Windshield indicator of new automobile speed control, with dial and lights that show when city speed limits are exceeded

AUTOMATIC GOVERNOR CHECKS SPEEDERS

A NOVEL speed governor for automobiles, proposed by a Minneapolis, Minn., inventor, compels motorists to slow down in congested districts. A white light on a windshield indicator changes to red whenever city speed limits are exceeded. If this occurs in open country, nothing further happens. When the car passes at high speed over a magnetized rail laid in the highway to protect a built-up section, however, an electric relay throttles down the motor.

THEATER FOR THE DEAF OPENED IN CHICAGO

A TALKIE theater serving deaf patrons exclusively, and accommodating 30,000 at once, has been opened in Chicago. At each seat is an electrical hearing aid of the latest design, consisting of a small oscillating device mounted on a convenient handle and connected by a cord to the theater's sound apparatus. By pressing the device against the bones of the face, as shown below, the user hears speech and music plainly.



A patron of Chicago's unique theater for the deaf uses electric hearing aid to enjoy talkies

TINY SAILBOATS TURN INGENIOUS WIND TOY

A HALF dozen miniature sailboats, pursuing one another along their circular course and shifting their sails automatically as they come up into the wind, ornament a revolving wind toy that an ingenious thirteen-year-old boy has constructed for his seaside home at Santa Barbara, Calif. The boats are faithful models of pleasure craft of the vicinity, and whenever the whirligig is spinning in lively fashion it is a good sign that a number of the real boats will be on the water taking advantage of the breeze.



Toy sailboats on this unusual whirligig tack automatically as they spin around with the wind

ELECTRIC GUN SHOOTS GREASE INTO BEARINGS

FIRING 40,000 tiny shots of grease a minute, a new electric gun is said to force the lubricant into fittings hard to lubricate with ordinary apparatus. Made of aluminum, and weighing only seven pounds complete, the gun is especially designed for greasing motor cars. Four pistons, at a touch of the trigger, begin firing their little charges of lubricant, building up cumulative pressure. A small electric motor drives the gun. It can be operated from any light socket.



An electric motor pumps grease into fittings



CAR'S OWN WINCH TOWS IT FROM MUD

WITH whizzing wheels, a huge motor truck stalled in the mud of a German field near Hanover, not long ago. By means of an ingeniously simple apparatus, it was able to tow itself out of the swamp. A heavy rope, attached to a tree in front of the truck, was run through guides to a small winch connected with the drive shaft

of the car, and the motor was started. A man at the rear "snubbed" the rope around the winch by pulling on the end, and the engine, racing at high speed, dragged the machine forward onto solid ground. Without this unusual equipment, the rescue of the truck would have been difficult, as any towing vehicle would have mired.

TANK CAN RUN ON LAND OR WATER



ARMY tanks that swim, as well as race across land, have been added to the military equipment of Soviet Russia. Recently, a number of the high-speed armored machines were put through their paces before government officials. In one impressive demonstration, five of the steel-clad amphibians maneuvered on a river, while experts watched, and proved they were as much at home in the water as they were on land. The new development in tanks will enable a fleet of the speedy land-and-water cruisers to crash through undergrowth, plunge into a river, swim across, and force their way up the opposite bank, unhindered by the width or depth of the stream.



Photograph shows how band-saw mender is used

ODD VIEW OF FENDERS FOR AUTOS

HIGHLIGHTS on the shiny new automobile fenders shown at right, give them an odd appearance. The shot shows a workman in a Michigan automobile factory examining the fenders before they pass on to the assembly line. Each twenty-four hours, fenders for 800 cars flow through the factory as part of the day's work.

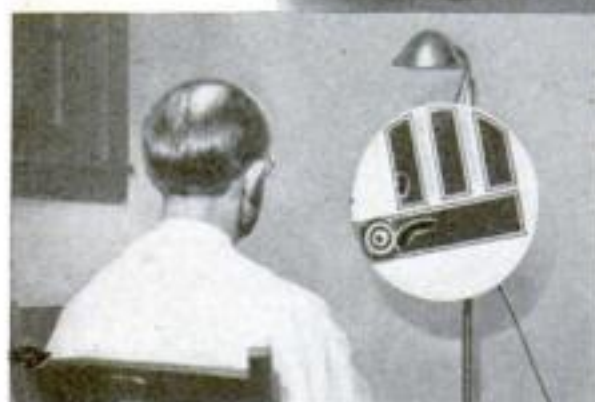
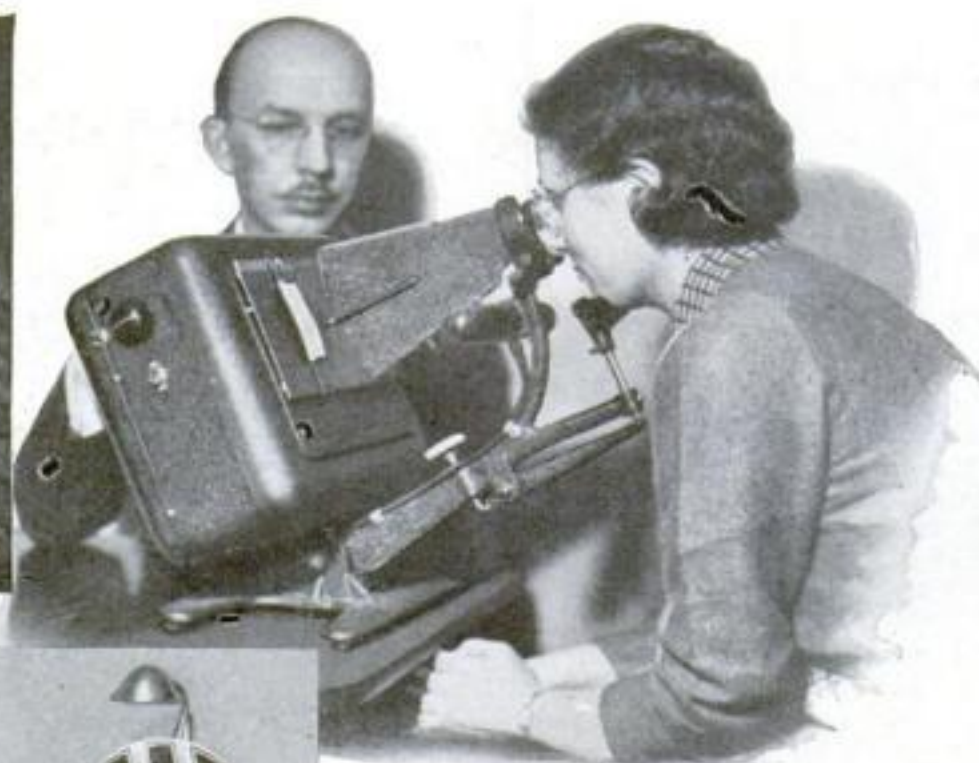
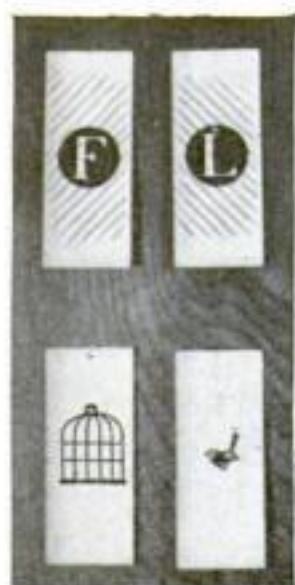


Automobile fenders being examined before going to the assembly line

PORTABLE ARC OUTFIT MENDS BAND-SAW BLADES

A PORTABLE electric apparatus for mending broken band-saw blades has been devised by R. J. Springall, an instructor at the Sacramento, Calif., High School. The ends of the blade are held by two guides, equipped with set screws, while twin carbon electrodes above and below, develop arc heat up to 2,800 degrees F. Silver solder is used. Tests are said to have shown the band saw is more likely to break in a new place than where the repair has been made. A handle fastened to the arm from which the top carbon is suspended enables the operator to regulate the amount of heat reaching the solder.

EXERCISER FOR EYES IMPROVES VISION



DEFFECTIVE eyes are now being helped back to normal vision in miniature "eye gymnasiums." New machines that give sluggish eye muscles veritable setting-up exercises are hailed as an important advance in optometry. Delicate muscles that train the eyes upon an object of interest, like the strings that animate marionettes, must work together in perfect balance and coordination. If there is a laggard among them, the balance is upset and cases such as "cross-eyed" vision

result. Glasses alone cannot always cure these cases, especially if the muscles and nerves of one eye have become impaired through disuse. To restore muscular teamwork, cards bearing mutually complementary pictures are placed in a machine called a "rotoscope" and adjusted until they seem to the patient to fuse into one. A letter "F" and a letter "L," for example, merge into a letter "E." The machine then revolves the cards slowly. Muscles of the eyes, following the movement, are trained to work in unison. Another recently developed eye exerciser is a large revolving disk bearing a brightly colored pattern of stripes and circles.



ARMOR PLATE PIERCED BY POWERFUL NEW REVOLVER

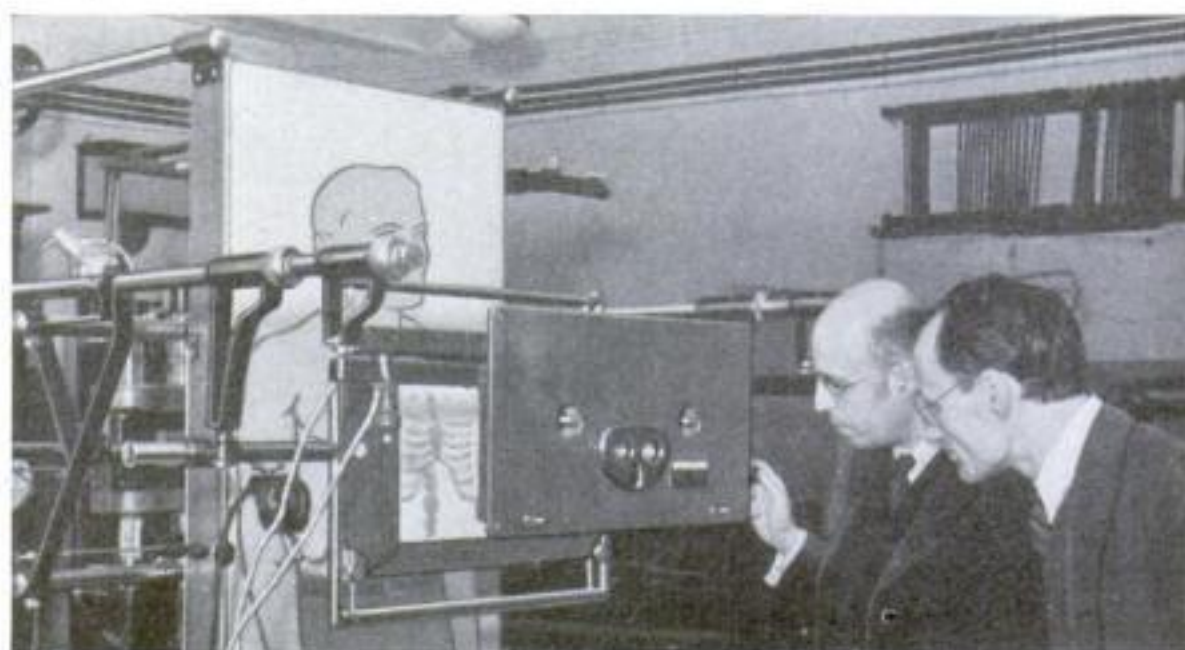
DECLARED the world's most powerful hand arm, a newly developed revolver using special cartridges of .357 caliber fires its bullets at the unprecedented velocity, for this type of weapon, of more than 1,500 feet a second. Traveling at this speed, the bullets pierce armor metal that is merely dented by other domestic and foreign revolvers, automatic pistols, and sub-machine guns. Bullet-proof glass does not offer a reliable protection against the new weapon, and a test made on an extra-heavy sample of bullet-proof vest material is reported to have shown conclusively that no such vest, capable of being worn invisibly or with any comfort, could resist its fire.



Chipped out of a slab of armor plate by bullet from the new revolver. Shots from other pistols could only dent the metal

MAGNETS CLEAN MOVIE LOT

TO KEEP a movie lot free of stray nails, wire, and other metal objects that would be unpleasant to step on, a California inventor has devised the "magnetic broom" pictured below. Coils of electric wire are mounted in a frame resembling an oversize lawn mower, and are energized by current supplied through a trailing wire. When the device is rolled along the floor or the ground, loose pieces of iron or steel are picked up.

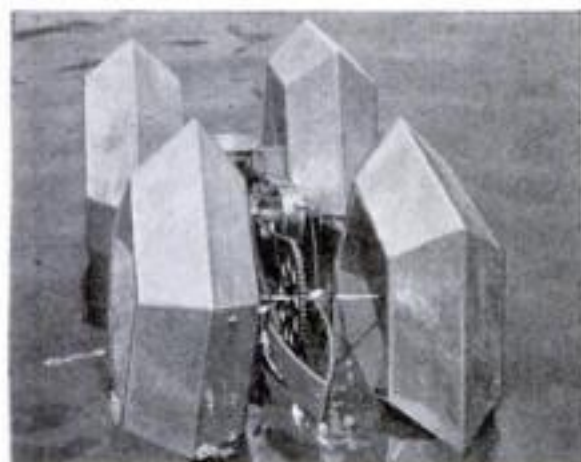


X-RAY MACHINE NOW SHOWS THREE DIMENSIONS

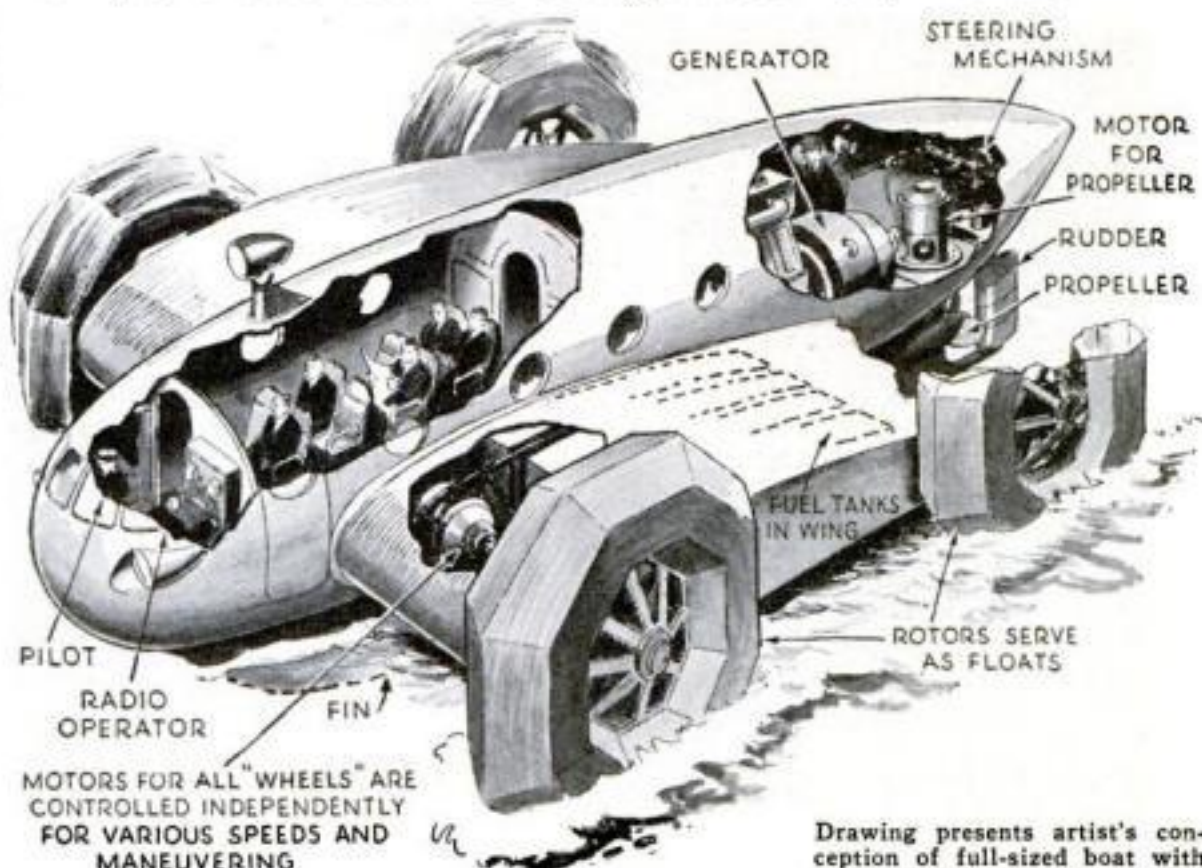
X-RAYS in three dimensions are provided by apparatus recently developed in Russia, and based upon the principle of the parlor stereoscope. Looking through a double eyepiece at twin viewing screens of fluorescent material, an observer sees a picture with lifelike depth, instead of the flat shadow ordinarily obtained on the conventional single screen. The improved view of a patient's internal organs as he swallows, coughs, or breathes is expected to be an important aid in the diagnosis of disease. The illustration above shows the new apparatus and how it is used.

Odd Craft Rides Waves on Octagonal Wheels

A WATER craft that runs on polygonal wheels, is the invention of a Mexican lawyer. Four of the hollow, buoyant rotors serve as floats to support the fuselage-shaped cabin clear of the water, while a standard marine propeller at the stern provides the power to roll it along. Power may also be applied to the wheels themselves for increased speed. The unusual shape of the rotors is of no technical advantage, but was introduced to add to the novelty of the design.



Inventor's model of novel wheeled water craft



Drawing presents artist's conception of full-sized boat with fuselage for carrying passengers

Little-Known Facts About Metals

SELLING plated objects as pure metal became so prevalent a swindle in old England that King James IV had a law passed, forbidding the coating of any base metal with gold or silver. Evidently the King enjoyed a sly jest, for the law added that it would still be perfectly legal to plate gold or silver with the base metals.

SPANISH counterfeiters, however, once manufactured fake money by covering disks of platinum with a plated coating of gold or silver. In consequence, Spain forbade, for a time, the importation of platinum, which was not highly valued.

EARLY ROMANS knew the advantages of lead plumbing. They used lead sheets to line their famous baths, and manufactured drain pipes by bending lead sheets around cylinders.

AN ANCIENT formula for imparting a specially fine temper to a sword blade of Damascus steel, required that the weapon be heated to "the color of the rising sun" and passed, six times, through the body of an Ethiopian slave. "Then," the formula continued, "if with one stroke the master workman severs the head of the slave from his body and the sword displays no nick or crack along the edge, and the blade may be bent around the body of a man and not break, it will be accepted as a perfect weapon."



The Vikings drew wire through dies 1,200 years ago



Red-hot sword blade waved by a horseman to temper metal

A MORE humane way of tempering a good blade was to give the red-hot weapon to a horseman who galloped away at full speed, swinging the sword around his head so that the air would cool it more rapidly.

TESTS recently made on several Damascus swords showed that they are worthy of their traditional fame. They could sever a woman's hair floating in the air, and be bent into a circle with the point touching the hilt.

PLINY, the naturalist, relates that the Romans of the first century preferred cooking vessels made of tin-coated iron because such pots were known to withstand the corrosive action of foods better than utensils made of iron alone.

DRAWING wire through dies to reduce its diameter might seem to be a modern art, but such dies dating as far back as 700 A.D. have been found in Viking tombs in Norway. Previously, wire was made by twisting thin pieces sheared from plates of metal. When a considerable length was required, several pieces were soldered or brazed together.



"DANGER METER" GAUGES PERIL OF FOREST FIRES

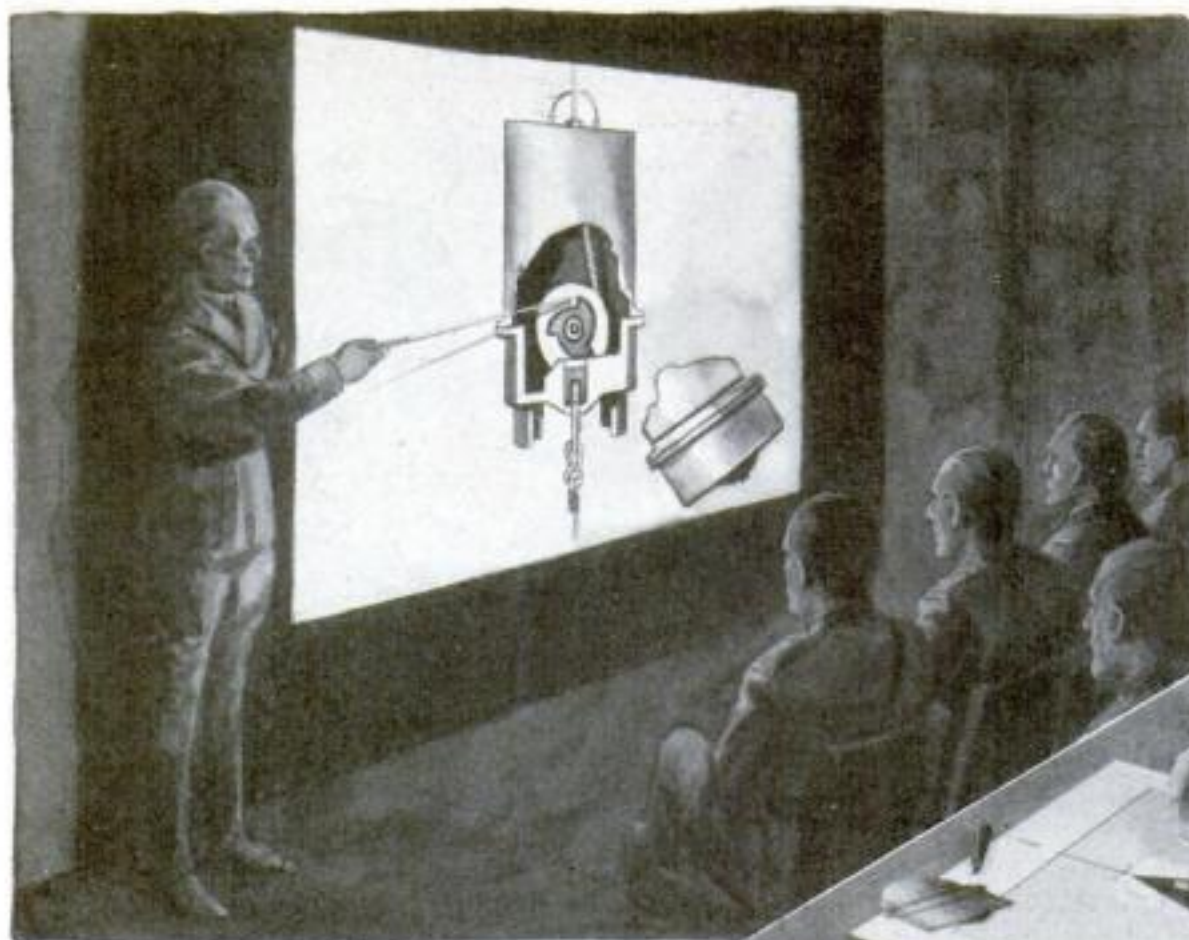
WHETHER timber losses by fire have been excessive is quickly determined with the aid of a new "forest-fire danger meter" developed by Government experts. Its sliding scales take into account all factors conducive to forest fires. When the scales have been adjusted, the meter indicates the relative degree of fire hazard that existed in a given area at the time under consideration.

EXPLORERS SAY PYGMIES CAN TALK TO GORILLAS

THAT pygmies of one African tribe have learned to talk with gorillas, in a language that both can understand, is hinted by recent reports. Explorers say that the men and apes use in common a number of recognizable cries resembling human words, apparently permitting some sort of communication. This may explain why the dwarfs and the gorillas get along peacefully with each other, whereas the gorillas attack full-sized Negroes.

By
James Nevin Miller

At left, soldiers watch an animated cartoon which shows the mechanical principle of a submarine-mine anchor. Below, Sergeant Lloyd, cartoonist, at work



ANIMATED CARTOONS have joined the United States Army. The technique which made Mickey Mouse, Oswald the Rabbit, and Popeye the Sailor Man internationally famous is being applied to teaching rookies the fundamentals of military science.

In a miniature Hollywood at Washington, D. C., Army experts under the direction of Capt. M. E. Gillette are making, developing, printing, and distributing animated sound movies unlike anything hitherto attempted. With special cameras and apparatus, developed at their Signal Corps laboratory, the artists are portraying how soldiers maneuver in battle, how the internal mechanism of a big gun works, how projectiles explode, and how mechanical aids to Army work are assembled and operated. Officials report that these new sound-movie methods of teaching are far more effective than others previously tried.

Under an arrangement with the Academy of Motion Picture Arts and Sciences, Capt. Gillette spent six months in the large studios of Hollywood in 1932, learning the technique of the animated sound movie. The year before, another officer, Capt. F. W. Hoorn, received the same training and this year a third Army man, First Lieut. Charles S. Stodter, is on the West Coast learning the fine points of the work.

A tiny room in an out-of-the-way building on the grounds of the Army War College is the scene of the experiment. Here, two crack artists, Sgt. Robert E. Lloyd and Vernon Snow, the latter a civilian, spend their time working with cut-outs, India ink, and celluloid.

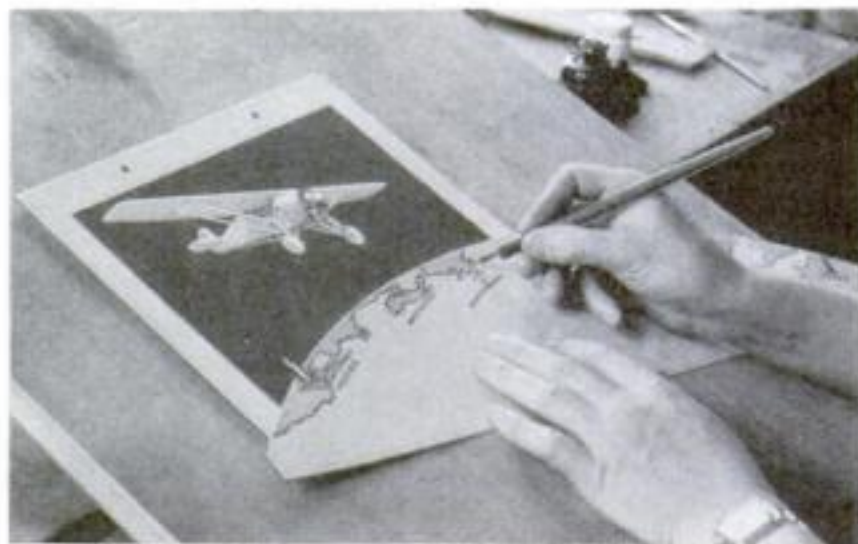
Sometimes, their job demands work so fine they have to put on the finishing touches with the aid of a magnifying glass. This was the case in a recent reel showing the steps in laying submarine mines to protect a harbor. The boats in the picture were so minute they barely could be seen and they moved hardly one sixty-fourth of an inch between successive pictures. In making part of the reel, the artists worked eight hours a day for four days to produce a strip of film that runs through the projection machine in a minute and a quarter. You see

ARMY'S Animated Cartoons MAKE BETTER SOLDIERS

approximately twenty-four drawings a second when you watch an animated cartoon on the screen.

As everyone knows, such films are produced by a series of drawings, each filling a frame, or individual section of the film. The succeeding drawings represent successive stages in movements. Appearing rapidly, one after the other, on the screen, they create the illusion of motion.

In the studio, the army artists first draw in the landscape on a large sheet of the finest grade ledger paper. Then they sketch the figures or objects which are to move on sheets of celluloid. Each motion is represented by a cycle of drawings. The final step is placing the celluloid sheets on the landscape background and photographing them one after the other with a special camera that records them as a series on a strip of movie film. The landscape shows through the transparent celluloid so the two drawings are photo-



An artist preparing a movie representing a long-distance flight. The curved map will move, producing the illusion of actual flying

graphed as one. Sound is "dubbed in" later on.

The completed reel represents thousands of separate drawings, each occupying a sixteenth of a foot on the strip of film. The original sketches are made in outline only, with India ink and a stubby pen. After the precise workings of the action have been developed, intermediate tones between the sharply contrasted blacks and whites are introduced to give greater realism.

Flashed on the screen, these new animated movies are teaching infantry and cavalry tactics, demonstrating how machines of war are handled and cared for, and visualizing large areas of country with the strategic moves of an army advancing to battle.

Commanding officers as well as rookies are profiting from the new teaching technique. Before their eyes, with sound and motion, various problems of handling troops under different battle conditions are visualized.

Many of the reels show mechanical motions. Such things as what happens inside a gasoline engine when you step on the starter are made clear upon the screen. The animated cartoon is an ideal method of teaching involved mechanical movements. Observers see the outer parts of a machine break up and fly away, leaving the internal mechanism working.

In one reel, for example, the audience watches what goes on inside a big gun when it is fired. Every step in the explosion and recoil is depicted on the screen. One short section of the film, which shows how the oil flows within the recoil chamber of the cannon, required 160 separate drawings. It took a week's work to complete the series of pictures which appear on the screen for only six



This automatic camera, specially designed by Army technicians, is used in the Signal Corps laboratory in Washington in making cartoon movies. Each of the drawings is photographed

seconds. But, during that six seconds, a highly complex operation is made clearer than an hour's talk could make it.

In addition to the use of celluloid sheets superimposed on paper strips carrying the backgrounds, the artists employ cut-outs to create realistic effects in the animated cartoons.

During the past few years, a number of

educational institutions, notably the University of Chicago, have been turning to animated cartoons as a teaching medium. Now, the United States Army has adopted a similar experiment. With its initial test an unqualified success, mass instruction by screen methods is likely to become an important feature in military training in future years.

Vitamin Food Made from Carrots



EATING carrots with a medicine dropper is now, figuratively speaking, a scientific possibility. From a carload of the familiar and often-maligned vegetable, experts have found a way to isolate a pound of deep-orange crystals that offer a new weapon against disease. The rare substance of which they are composed, known as carotene, has been identified as the pigment that gives carrots their characteristic color, and has also been found in butter, milk, spinach, and various leafy foods. Its medical significance lies in the fact that the body has the power to convert this substance directly into Vitamin A. If a person normally consumes carrots, milk, spinach, and the like in his diet, he probably gets all the Vitamin A he needs. People who do not enjoy these foods, can boost their Vitamin A supply, whenever the physician advises, by adding to a meal a little carotene, dissolved in a few drops of cottonseed oil.

A bunch of carrots in contrast with the crystals they yield

Left, carotene under the microscope. Below, globular capsules for doctors, and right, making a spectrophotometer test.

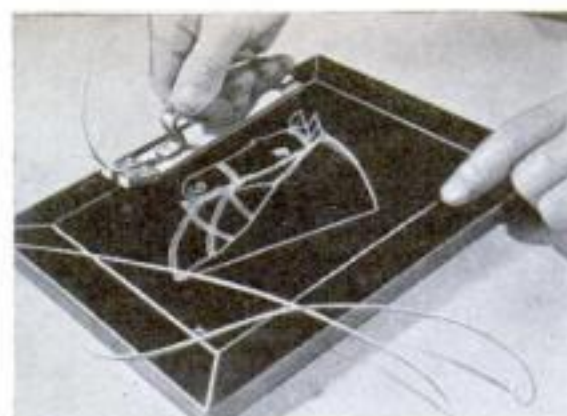


HARVESTER AIDS NEW RUBBER CULTURE

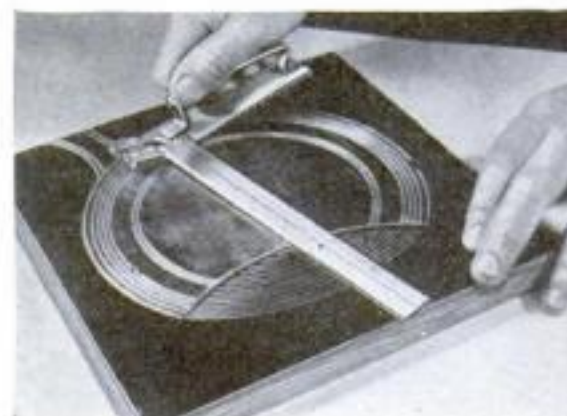
WILL America, some day, grow and make all its own rubber? Experts of the U. S. Department of Agriculture are carrying on today the work of the great inventor, Thomas A. Edison, in attempting to extract

cheap rubber from goldenrod. Meanwhile a California concern has been developing the production of rubber from guayale, a shrub resembling sagebrush, and its latest aid is the curious harvesting machine pictured below. The harvester follows another machine that pulls up the plants and stacks them in long rows. It picks up the plants, tears them to bits in a shredder, and blows the shreds through an arched, overhead duct into a trailer. The operation is automatic, requiring only one man to guide the machine and another to spread the plants evenly as they come from the chute. At a nearby mill the shreds are converted into blocks of rubber weighing approximately 200 pounds apiece.

This odd machine is used in harvesting guayale, a sagelike plant from which rubber is now being made



Making inlaid border with new routing tool



A pattern of circles made by compass bar

NEW HAND ROUTING TOOL MAKES INLAY WORK EASY

HANDSOME inlay work is made easy for home craftsmen by a hand tool now on the market, consisting of a holder, three cutter blades, and a compass bar. Strips cut with the tool from one piece of wood are said to fit perfectly in the grooves cut in another piece, and straight or circular designs can thus be executed with facility. The tool may also be used for fluting and routing. It is of particular interest to the man who makes his own furniture.

SHAVING BRUSH HAS A COIN BANK IN HANDLE

A COIN BANK, built into the handle of a new shaving brush, provides a daily reminder to save. Coins are inserted through a slot near the top, which is then closed by a slight turn of a knob at the end. Turning the knob farther opens the bank and releases the coins, when the bank is full. After the brush is worn out, it may be unscrewed and replaced. It is so constructed that water or soapsuds cannot enter the compartment containing coins.



BUILDS FIVE-FOOT STAGECOACH MODEL

AFTER four years of spare-time labor, E. K. Brubaker, of Berlin, Pa., has just completed the five-foot stagecoach model illustrated below. POPULAR SCIENCE MONTHLY blueprints provided the design for the coach, which the home craftsman embellished with six horses carved from California redwood.



E. K. Brubaker with his remarkable model of a stagecoach with horses

FIRE TRUCKS CARRY SHORT-WAVE RADIO



Short-wave radio set installed on fire truck for two-way communication

FIGHTING FIRE with the aid of radio is an experiment now under way in England, where trucks have been equipped with short-wave transmitters and receivers for two-way communication with headquarters over a range of about twenty miles. The mobile transmitter, shown in use above, employs a roof antenna. Through its use, the first apparatus to arrive at a fire can report its extent so that additional engines can be dispatched at once or held in reserve, as the situation indicates. The innovation is reported of particular value in country districts where telephones are scarce.

The Man



with the Net

FREE OPERATIONS were offered as the prizes at a recent benefit dance given for a hospital in Los Angeles, Calif.

COLORED POTATOES—red, yellow, and purple, have been produced at a government experiment station by crossing native varieties with wild foreign species.

PINE-CONE FIBERS are used in the finest instruments for recording changes in humidity.

THROUGH a half-inch hole cut in an eggshell, and covered with thin glass, students in a New York laboratory watched an embryo develop into a baby chick.



LOBSTERS from Hawaii were recently found 12,000 miles away along the coast of South Africa. The migrating species, first known only around the Hawaiian Islands, has already half circled the globe.

EIGHTY MILLION stray cats live in the United States.



ALTHOUGH they live in water and breathe through gills, crayfish are not fish.

AMERICA got its name, according to a Mexican archaeologist, not from the explorer, Amerigo Vespucci, but from a Mayan word, "Ame-ris-kin," meaning "Land of the Brilliant Sun."

MUSICAL FISH live in the Gulf of Mexico. Called the sirens, the little fish give off a tinkling sound, like the ringing of tiny bells, at sunset.

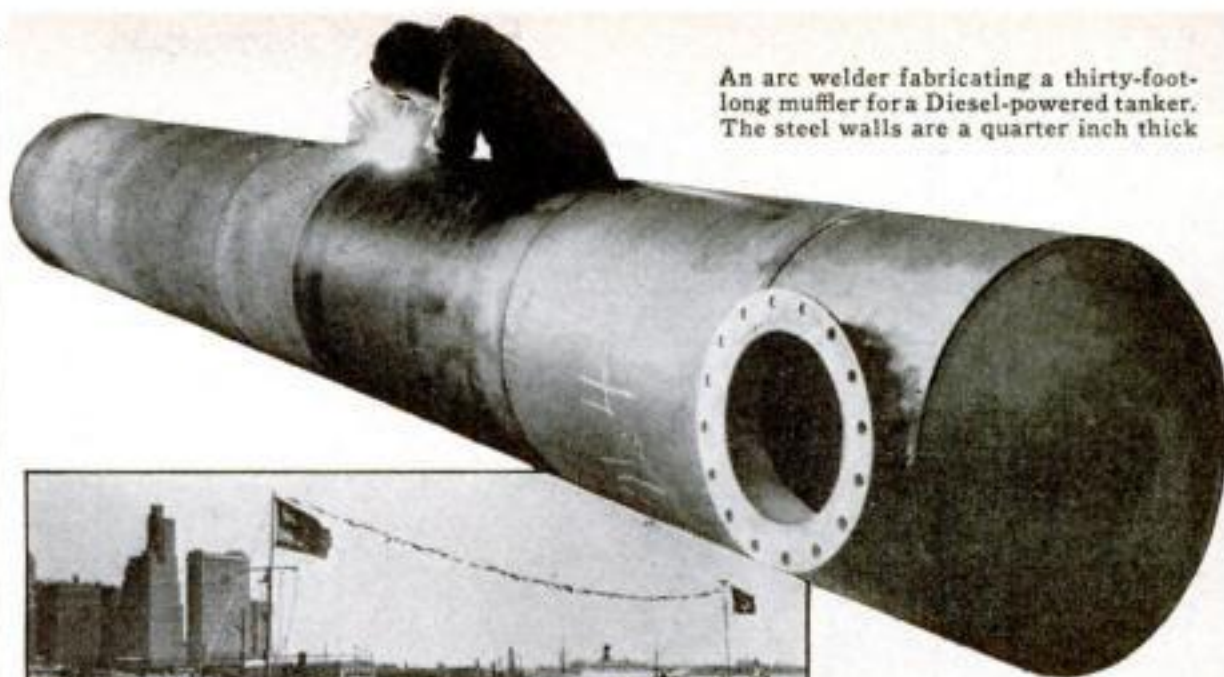


WESTERN legislators once voted on a bill that proposed a saving in the printing costs of scientific reports, by changing pi from 3.1416 to three.

ONE-FORTIETH as heavy as water, silica fluff is said to be the world's lightest powder.

BORN without a brain, a baby in Russia lived for sixteen hours.

OWLS have flaps of skin to close their ears when they want to shut out noise.



An arc welder fabricating a thirty-foot-long muffler for a Diesel-powered tanker. The steel walls are a quarter inch thick



Left, the motorship in which the muffler illustrated above was installed. It will run between New York and lake ports

HUGE MUFFLER QUIETS DIESEL TANKER

Just as automobile motors need mufflers, so do the Diesel engines of the big motorships that now ply inland waterways. To suppress their noise, monster silencers thirty feet long and five feet in diameter have been designed. Since a

backfire on such a scale amounts to a veritable explosion, the cylinders are built of steel a quarter of an inch thick to withstand the occasional strain. The silencer illustrated has just been installed in a mammoth Diesel-powered oil tanker.

REVERSE-ACTION CAPS MARK POISON BOTTLES

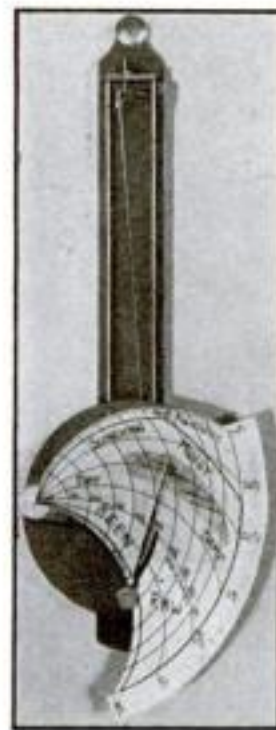
SCREW-CAP bottles with left-hand instead of right-hand threads are proposed for poisons by a Davenport, Iowa, inventor. If the poison bottle is mistaken for medicine, in the dark, an attempt to unscrew the cap in the usual direction simply jams it tighter, providing a warning reminder. To open the bottle, the cap is turned the "wrong" way.



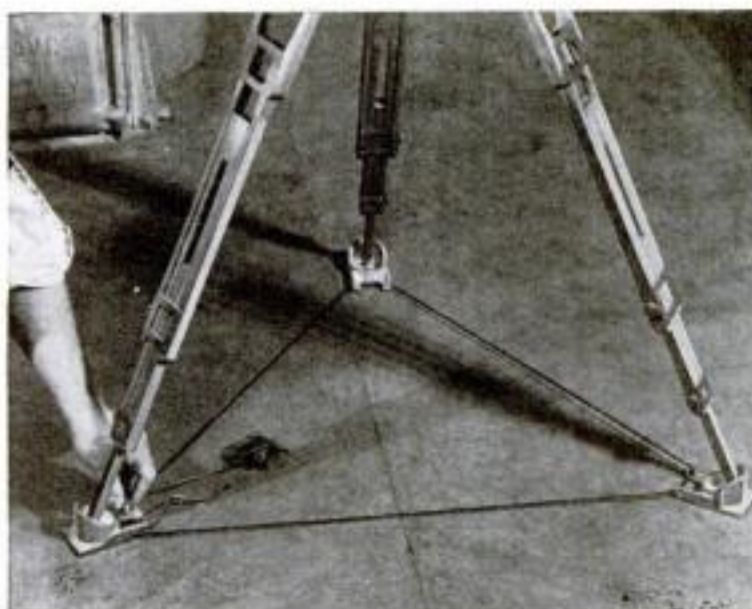
Caps for bottles containing poison turn to the right to open, making it impossible to use them unintentionally

REGISTERS HEAT AND HUMIDITY

TAKING both temperature and humidity into account, a new "comfort meter" shows if the weather is "raw," "muggy," "dry," or "keen." Humidity changes swing its pointer across a dial that rotates in response to variations in temperature, the functions of two instruments thus being combined so that a single reading is given.



TRIPOD IN OVERSHOES CANNOT SLIP



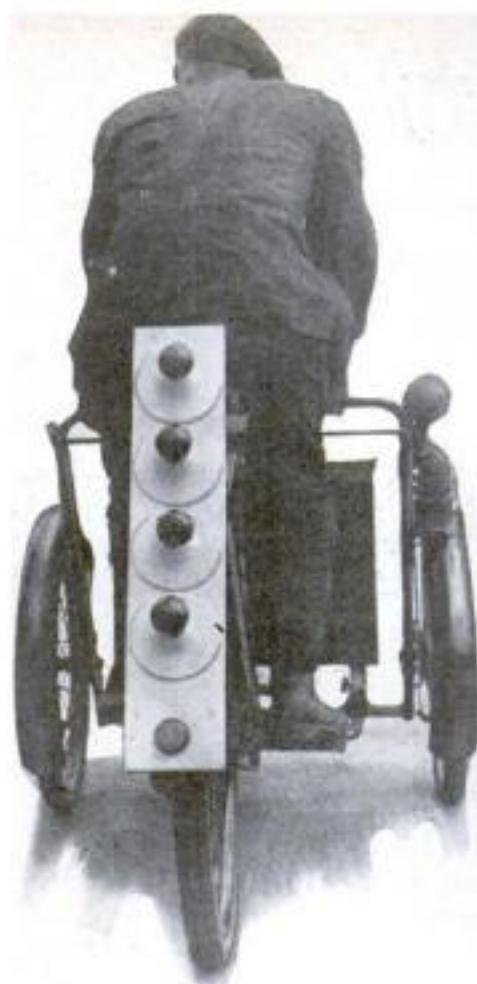
Adjustable tripod brace in use for setting up a camera on a slippery floor. The cups are joined by a flexible cord

AN ADJUSTABLE tripod brace of new design makes it easy to set up a camera tripod at unusual angles, or on a slippery floor, without danger that the legs may skid. Each tripod leg rests in a metal cup with a ribbed base of rubber, and the three cups are joined by a stout, flexible cord. A screw clamp on one of the cups permits the length of the cord to be adjusted at will. Once the tripod has braced at the desired height and slant, it may be shifted from one place on the floor to another without disturbing the relative positions of the legs. The brace can also be used on tripods of surveyors' transits.

CRUDE POWER PLANT LIGHTS SHANTIES

A POWER PLANT built from odds and ends provides the occupants of two modest shacks on the shore of San Francisco Bay with electric light and entertainment. George Williams and Harry Lucas, members of a little colony of driftwood gatherers and casual laborers, rigged a homemade windmill on a ten-foot pole. Gears from a discarded washing machine and a generator and storage batteries from junked cars completed the crude but effective installation. When the wind blows, the generator charges the batteries. The current thus obtained lights a fifty-watt incandescent lamp in each of the cabins, and runs a venerable, battery-operated radio receiver that entertains the colony.

George Williams, one of the builders of the crude power plant, reading in his shack by light the plant produces



TRICYCLE GUIDES BUS THROUGH FOG

WHEN fog imperils traffic in London, England, the huge omnibuses that lumber along the city streets resort to a strange safety expedient. Ahead of each bus rides a man on a tricycle, who operates a battery of signal lights at the rear of his machine, showing whether or not the way is clear. Because of the slow pace at which all traffic is compelled to travel at such times, the cyclist has no difficulty in keeping pace with it; the bus driver however, must keep behind the tricycle.



Two members of squatters' colony on San Francisco Bay, adjusting windmill that gives them light

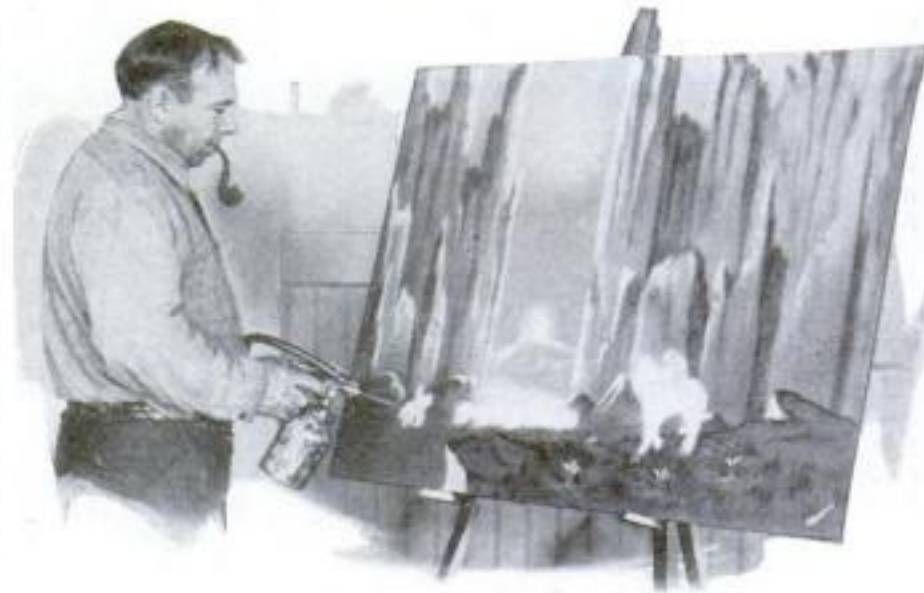


VERTICAL SIDETRACK AIDS TUNNEL BUILDERS

WHERE workmen are tunneling to complete the Colorado River Aqueduct, a curious mechanical device gets "empties" out of the way of full cars leaving the heading, without recourse to switches. Known among the laborers as the "cherry picker," it seizes the empty car and hoists it to the tunnel roof, as shown above, so that the other can pass beneath.

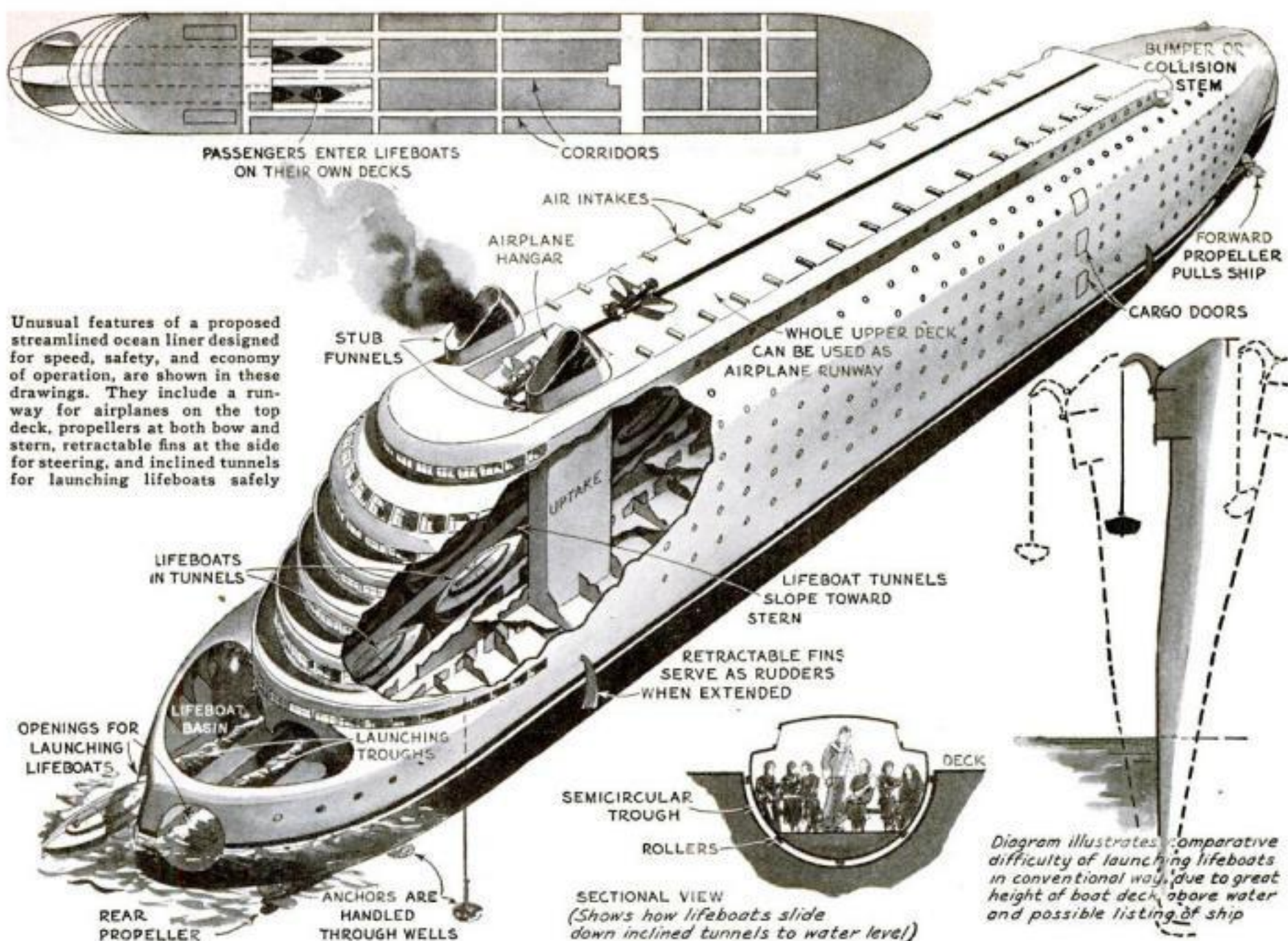
PAINTS PICTURES WITH SPRAY GUN

AN AUTOMOBILE spray gun becomes an artistic tool in the skilled hands of Fred Lawrence, Oklahoma City, Okla., car decorator, whose spare-time hobby is shooting out portraits and landscapes with compressed air and lacquer. Retouching is unnecessary, and effects are secured that could not be obtained with a brush. The backing is composition board.



FOUNTAIN PEN HAS A MAGAZINE FOR STAMPS

NEVER at a loss for a stamp is the owner of a novel fountain pen devised by a British inventor. When he has finished writing and addressing a letter, the user has only to twist the barrel and a roll of stamps appears in a slot at its side. Twelve stamps may be inserted at one loading.



Safety Liner Has Lifeboat Chutes

SLIDING lifeboats smoothly into the water at sea level, instead of dangling them precariously from davits high above the waves, is the means proposed by a New York inventor for carrying passengers and crew to safety in case of accident at sea. The novel scheme for launching boats is a part of a design that he has evolved for a new type of ocean liner combining speed, safety, and economy of operation. Inclined

tunnels within the after end of the vessel serve as launching ways for large, motor-driven lifeboats, which slide on rollers into a basin open to the sea and emerge through openings in the stern. Since the boats take to the sea on an even keel, there is no danger of capsizing, and they may be launched without difficulty even when the vessel is listing at an angle that would make it impossible to lower half the

lifeboats of a conventional liner. Other striking features of the proposed design include a streamlined superstructure, a top deck that serves as an airplane runway, and the use of propellers at both bow and stern, together with finlike rudders along the sides, to distribute strains evenly along the hull instead of concentrating them at the stern, as in the case of ships of conventional design.



PLUNGER CHARGES NEW HIGH-POWER AIR PISTOL

SUITABLE for target shooting and hunting small game, an air pistol of new design discharges its projectiles with such force and velocity as to give high accuracy of fire. Either lead pellets of .177 caliber or darts are used as ammunition. To charge the gun with compressed air, a plunger just below the rifled barrel is drawn out and forced back several times, as shown above, operating an air pump. The air charge thus stored is released by pulling the trigger.

WHITE ROBES CAMOUFLAGE SOLDIERS

GARBED in flowing robes and hoods of white, artillerymen of a Polish mountain battery presented a striking appearance as they maneuvered their guns into position, during recent military maneuvers among the snow-covered Carpathian peaks. The odd costumes served the purpose of camouflage, rendering the soldiers virtually invisible against the background of snow when viewed from the air. Squares of white cloth rigged on poles above the guns concealed them. The picture shows five white-clad men and a field gun.

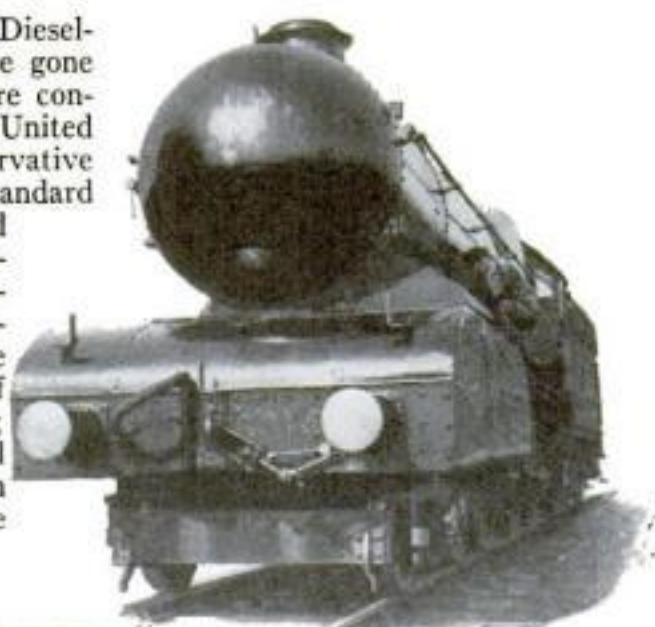




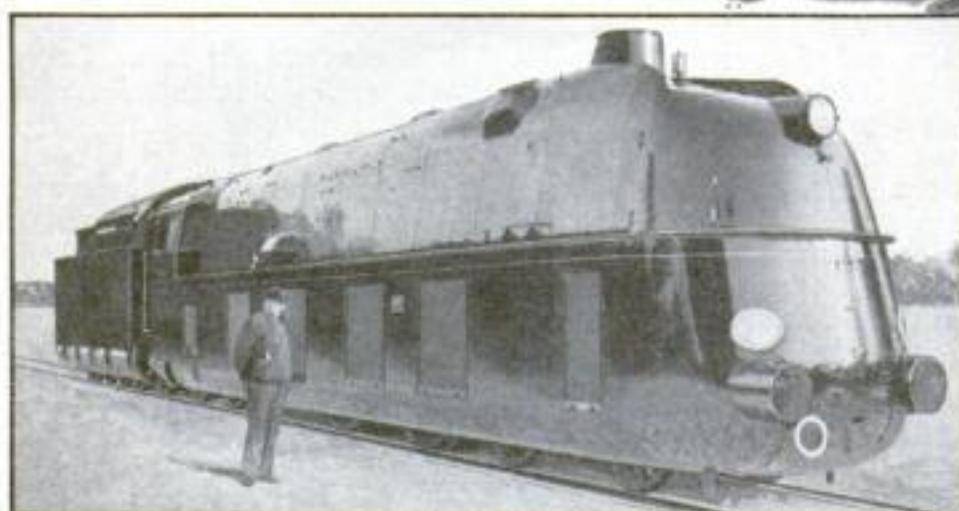
The New York Central's *Commodore Vanderbilt* hauling the *Twentieth Century* out of Chicago

STYLES IN STREAMLINED ENGINES

MEETING the speed challenge of sleek Diesel-powered engines, steam locomotives have gone streamlined too. Pictures reproduced here contrast the forms they have taken in the United States, England, and Germany. Conservative British engineers simply have fitted a standard engine with a rounded, "bullet" nose and smoothed the lines of boiler, cab and tender with steel sheathing. Far more striking is the New York Central's *Commodore Vanderbilt*, which now hauls the *Twentieth Century Limited* on a part of its run between Chicago and New York; it has a streamlined shell that covers all but the drivers. German engineers, in their latest model, even enclose the immense driving wheels.



Above, a British locomotive with bullet nose and streamlined cab, boiler, and tender. It pulls a crack express



This new German locomotive is the limit in streamlined steam engines. Even its great driving wheels are covered

LAPP SCHOOLHOUSES ARE ALL CELLAR

WHEN children of Lapland go to school, they enter the building through the roof. Because of the severity of the climate, the schoolrooms are sunk below ground, and only the rooftops are visible from the exterior. In this Arctic region, the sun never rises at all during midwinter, nor sets during midsummer, the season lasting two or three months.



Rooftops of schools in Lapland. The buildings are sunk in the ground

STANDARD PARTS FORM TEMPORARY BUILDINGS

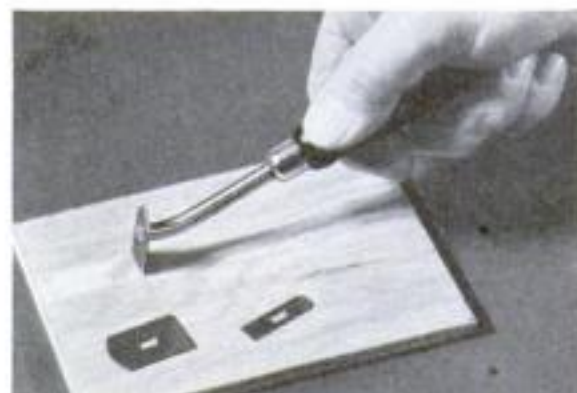
STRUCTURAL materials resembling the parts of a toy construction set have been devised by a Dutch professor to save time in erecting and dismantling temporary buildings such as meeting halls and grandstands. Perforated metal bars, interlocked by removable hooks, may be assembled in a variety of patterns, and are standardized so that they are interchangeable. When the building has served its purpose, the parts may be disassembled and used over again elsewhere, or stored in a comparatively small space to await future need.



Staircase being constructed of new material which resembles children's building-toy sets

CANNON END SNOWSLIDES

WHEN avalanches recently endangered trains traversing an Alpine pass near St. Moritz, Switzerland, army men used artillery to end the menace. By hurling explosive shells at the slopes, they jarred down the loose snow, and the tracks were then cleared for traffic by snowplows.



SCRAPER HAS MANY USES

THREE reversible blades, providing straight, curved, and V-shaped edges, adapt a versatile new scraping tool for a variety of tasks in the home and shop. The device takes paint or putty off window panes, and removes paint, varnish, or grease from woodwork. It also offers a handy tool for antique refinishers, and for the housewife in scraping kitchen utensils.

NEW UNDERSEA ESCAPE IS COMPLETE BABY

1 MINIATURE SUBMARINE UNDER WAY AT SURFACE WITH PERISCOPE AND VENTILATOR EXTENDED.

2 STARTING TO RIGHT ITSELF

1 ESCAPE DEVICE LEAVING SUBMARINE

UNDERWATER life miniature submarine, diving towers, motors and ventilators, for saving lives in. Fitting like plugs, special compartments large submarines, the bobs would be located in emergency, the crew them, seal them up. Rising like bubbles in the sea, the midget submarines, flash out and nearest port under the idea, worked out by one of the most in-

Drawn by the submarine, the sea "boat" t

Drawing shows how a stricken submarine, resting on the bottom of the sea, would put out baby "bubble boat" to carry its crew to surface



SUGGESTING a stock ticker, and having three flasks within its glass dome, a new device installed at English bathing pools tests the water for chlorine content. Water is drawn into the central flask and mixed with chemicals which react to the chlorine and turn the liquid yellow. Bath-ers contrast the hue with test colors in the flask at either side.

Dog dinners de luxe delivered by automobile on papier-mâché platters covered with waxed paper, are now available for Eastern pets. With branches in ten towns and cities, a firm of canine caterers makes deliveries three times a week. The menu consists of cubes of fresh lean beef or lamb, broth, shredded cabbage or lettuce, and crushed zwieback. At the headquarters of the firm, seventy-five breeds of dogs are listed. The breed and weight of the dog determines the amount of food it receives. Each branch has its sanitary diet kitchen, equipped with electric refrigerators and delivery trucks.

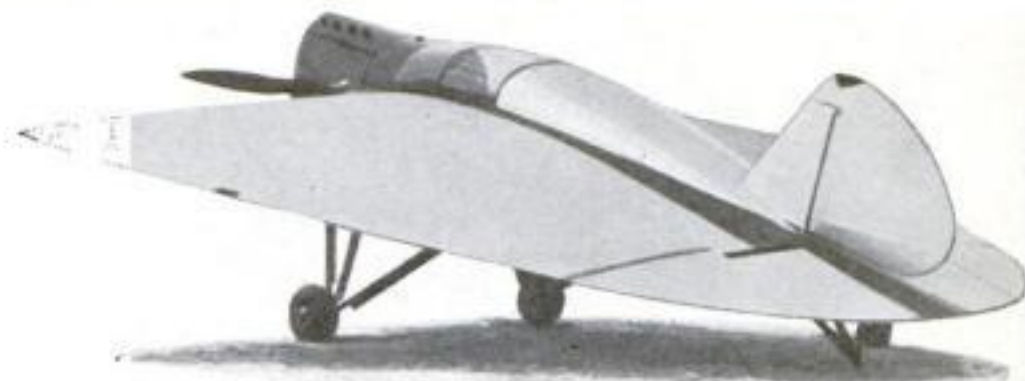


CHOPPING documents into mincemeat, a new electric apparatus recently demonstrated in Germany makes the destruction of such papers a simple matter. The cutting machine is so designed that the papers which are destroyed are turned into minute bits which even the most careful patching can never piece together. Organizations handling confidential reports, which are later destroyed, are expected to adopt the apparatus, because of its effectiveness.

CHANCE produced a new stall-indicator for airplanes at recent tests of a novel half-moon plane in Florida. To ventilate the cockpit, a pipe three feet long and

two inches in diameter was run from the leading edge of one wing, as shown, to a position beside the pilot. Air rushing through it not only ventilated the cock-

pit but gave a low-pitched howl every time the machine neared stalling speed. This noise serves as a warning signal, informing the pilot of the situation.





PLEASURE AND PROFIT IN Raising Dogs for Sale

*Roadside Farms, with their Pens of Playful Pups,
Are Now a Characteristic Part of the Highway Scene*

By WALTER E. BURTON

THE joke about the man who kept the wolf from his door by eating it, has been worked out in practical form by a great many people who have found profit in a new kind of "farming." By raising dogs and selling them to others, they have succeeded in making a living, frequently a comfortable one. And, after all, the dog is a near relative of the wolf.

If you drive along almost any well-traveled highway, you will see evidence that the dog-raising business is one of no small proportions. Roadside signs proclaim the presence of dog farms or kennels that specialize in certain popular breeds, or else raise and sell all kinds of dogs. Some of the more enterprising operators, realizing that the best advertisement for a dog is the dog itself, have constructed roadside stands in the form of wire-enclosed cages or pens, in which the dogs are displayed. Frequently a pen full of pups is used as bait to attract the passing motorist.

In addition to the business of raising and selling dogs, there are numerous boarding farms where dog owners can leave their pets, with the assurance that they will be cared for as well as if they were at home, and frequently better. Sometimes such boarding establishments undertake to treat dogs for diseases or injuries, thus becoming in effect dog hospitals or sanitariums.

If you are thinking of going into the dog-raising business, pause first to con-

sider the requirements involved. The first, and one that usually is not difficult to satisfy, is a love for dogs. If this love is specialized so that it includes only one or two breeds, then a specialized business is the logical type. You may prefer to raise chows or terriers or bird dogs, while a dog raiser in the next township will specialize in rabbit hounds or German police dogs, because he is fond of those breeds.

Perhaps next in importance is a thorough knowledge of dogs and their ways. If you are not familiar with the breeding, feeding, and general care of dogs, you stand

slight chance of making a success of the dog-raising business. Many dog farms are operated by men who are trained veterinarians or who have been associated with animal specialists.

The equipment required for dog farming is not elaborate. Usually, it is not difficult to find a roadside site that can be rented or leased at a reasonable figure. There must be ample room for the dogs, plenty of shade, and preferably a stream or lake near-by. One dog-farm owner, who maintains a colony of about 200 dogs,



Feeding time at a dog farm. A mother beagle and her three-months-old puppies



The roadside pen full of lively puppies is a familiar sight on nearly all well-traveled highways. It never fails to attract motorists' interest



A TYPICAL ROADSIDE FARM

Left, a dog farm located in a shady grove. The kennels are made of discarded refrigerator linings. Below, a rakish five-months-old greyhound



keeps most of them in a wood from which the underbrush has been cleared. He solved the housing problem by procuring, at low cost, a number of enameled steel shells that originally were intended for electric-refrigerator linings. These, laid on their sides, make excellent weatherproof kennels when a quantity of bedding material is added.



The terrier is easy to train

Usually, some kind of central building, for the storing of food, medicines and other equipment, is provided. This sometimes includes living quarters for the keeper. The chores connected with a dog farm are not particularly heavy, but someone must be in attendance most of the time. Usually two men are required for operating a farm whose dog population may be anywhere up to 200.

The best-selling dogs, according to the operator of a roadside farm near an Ohio city, are fox terriers, rat terriers, Boston bulls, and Eskimo spitz dogs. These are the most popular in that particular part of the country. Tastes tend to differ with each locality. This operator keeps on hand, in addition to his leading breeds, an extensive selection of other kinds.

The dog-selling business flourishes best in summer, when potential customers circulate more, and when outdoor activities make people dog-conscious. It is during the comparatively inactive winter period that the professional dog breeder can find time to become a schoolmaster and teach his young dogs certain simple tricks, which will increase their value perhaps several times over what it would be if they were just dogs. A customer is more likely to buy a dog that knows how to stand up, speak, shake hands, and smoke a pipe, than one that knows no tricks at all; and that customer is willing to pay a substantial price for such a dog. A fox ter-

rier that can do a few simple tricks will bring a price of \$15 or \$20 in a locality where the same dog, if untrained, would go begging for a purchaser at \$5.

If you own a dog that did not have the advantage of an acrobatic education, you will not find it a difficult matter to teach it a few interesting tricks. The fun you can have with an educated dog will repay you many times over for the trouble of training it.

Not all dogs will prove to be good performers, according to the operator of the Ohio dog farm, a man who has worked with dogs all his life. The ability to learn tricks varies with breed. The easiest dog to train, he has found, is the fox terrier. This dog, when properly handled, apparently has an unlimited capacity for learning how to do interesting things on command. Another type of dog that frequently learns with amazing ease is the ordinary mutt, the mongrel dog whose family tree is so hopelessly mixed that it looks like a brush heap. This ought to be good news to many small boys. The spitz, which makes an excellent house dog, also is capable of learning numerous stunts.



A three-months-old beagle pup

Some dogs are intelligent in a different way. While they do not learn how to stand on their heads or smoke a pipe particularly well, they display an amazing capacity for other types of training. An example is the shepherd dog. It does not learn acrobatic tricks readily, especially when compared with the fox terrier, but it masters farm activities easily. It seems natural for this dog to learn how to bring in the cows, guard children, keep chickens out of the yard, and do other useful things.

Certain dogs are extremely difficult to train. The average bulldog, for instance, is too stubborn to learn tricks. A dog that is half bull and half fox terrier

generally is easy to teach. Hounds are stupid when it comes to learning fancy tricks, but remarkably intelligent when their training has anything to do with hunting. Some dogs may seem dull even in ordinary things. For instance, you can hold five pounds of beefsteak behind a greyhound and it will not know that the meat is there until it sees it. This is because the greyhound has a poorly developed sense of smell. It apparently is built for speed only.

The first step in training a dog is to select the dog, according to a veteran dog breeder. In a litter of pups you will find some that gaze upward at you when you approach them, while others are content to stare at the ground. Select the ones that look up, if you want dogs that can be trained easily.

Make friends with your dog, and treat it with kindness. Make a pet of it. It is only by getting on the good side of a dog that you can train it with success. Kindness is the rule. Never whip or otherwise mistreat it; and always reward it for its efforts, when you come to the actual teaching.

A dog that is too full of pup ideas does not train well. Wait until it is from seven months to a year old before you attempt to teach it to do tricks. While you are waiting

(Continued on page 108)



The chow is a one-man dog and a good fighter

Your Microscope HAIR AND



By MORTON C. WALLING

YOUR microscope will demonstrate that anyone, unless totally bald, can boast a permanent wave; and that bird feathers are efficient flying structures largely because of the presence of tiny hooks.

The hair on your head and body corresponds to the feathers of birds and the scales of reptiles. Probably you think of it as a collection of simple strands, in themselves not very interesting. But a little exploring with your microscope will reveal that your hair is somewhat more complicated in structure than you supposed.

Cut a half-inch section from a hair and place it on a glass slide. Look at it at 100 diameters, or, better still, 500 diameters. You see a rod, apparently one third of an inch to one and one-half inches in diameter. The rod is translucent; it looks brownish by the transmitted light. Focus the microscope slowly. At one point the upper surface of the hair will be sharply defined; at another position, the edges will appear clear-cut. The surface, you perceive by this focusing, is marked by a great many fine, wavy lines running, roughly, crosswise of the hair. Thus, you see, the hair carries a permanent wave, for these markings are characteristic of human hairs.

Criminologists have attempted to use these waves as bases for identification and classification of hairs, to identify the person or body from which a certain hair came. Some experts claim that hairs themselves do not provide reliable means of identifying persons or races. On the other hand, it was reported not long ago that a microscopist had found a way of telling with fair accuracy the age of the person from whom a hair came, just by studying the spacing of the wavy lines.

If you wash a hair in ether to remove the oil, and then mount it in Canada balsam under a cover glass, you will not see

the surface markings as readily as when you examine it in air. Instead, the hair will seem to be more nearly transparent, and to show streaks running lengthwise, as if it were made up of parallel strips of some material.

Is the hair constructed like a cable instead of a rod? Let us explore this possibility. A look at the cross section of a hair ought to show something. But how can one make a good cross section of so small an object? One way is to bundle a great many hairs together until they form a little rod, and dip them into thin glue or paste. Let the adhesive dry, and then slice the resulting bundle crosswise with a razor, holding it either against a piece of cork or in a microtome.

In shaving, you can produce a supply of cross sections of your beard without trouble. First shave in the ordinary way. Then, while holding the skin taut so that the beard stands up, and without using soap or shaving cream, go over your face again with a perfectly clean razor. Transfer to a glass slide the scrapings which collect on the blade. Examine them with your microscope, and you will find numerous irregu-



Go over your face a second time. Then scrape the blade on a glass slide. In the cross sections of hair resulting, ends of threadlike hair cells appear, as in picture below

HUMAN HAIR
MAGNIFIED
250 TIMES

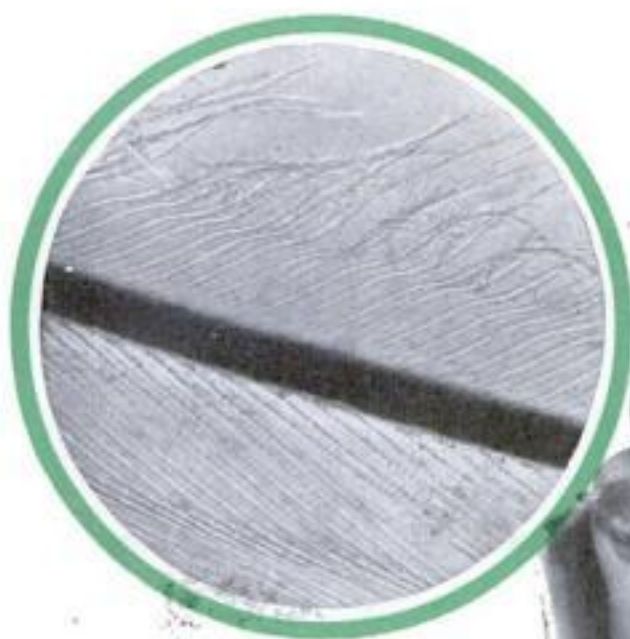
Not a tree trunk, but a human hair under high power lenses, the specimen at right shows a peculiar wavy surface resembling bark or rough skin



Above, the long, tenuous cells of which hair is made. To see these, you must first heat the hair in sulphuric acid, as at right, to "break it down" to basic structure



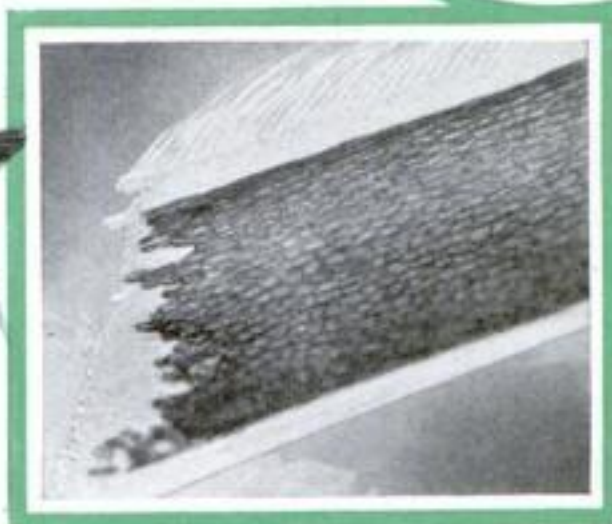
Reveals Secrets of FEATHERS



A secret of flight is revealed by the microscope. Note the tiny hooks on the feather shown above. They hold firm the flight feathers of the bird at right



Above, the barb of a down feather, magnified about 270 times. It is widely spaced because it is not important for flight



Left, the rough cellular structure of a barb at the point of greatest physical strain, just where it joins the stalk, or rachis. It appears scaly



MOUNTING SPECIMENS ON HOMEMADE SLIDES
Making special slides out of wood and cardboard, for dry-mounting. Black India ink is used to darken surface under specimen. Left, parts of slide

lar pieces of hair. Some of these will have been sliced more or less crosswise, so that you can see the hair structure. Most of the particles will be of odd shapes, as a result of being cut at different angles by the razor.

Examination of one of these cross sections reveals that the hair is made up of an outward bark or shell,—the wavy layer you first saw—enclosing a great many pieces arranged like sticks in a bundle. Near the center is an area that looks dark, as if it were filled with pigment. It is, however, not pigmented, but contains air which, under certain conditions of illumination, looks solid. This is the pith, or medullary region. With dark-field illumination, the openness of this center area is shown better.

But these examinations do not tell you

the whole story about the hair. Place a hair in fairly strong sulphuric acid and heat it carefully. It is not necessary to let the acid boil. After the hair has been in the hot bath a few minutes, transfer it to a drop of clean water on a microscope slide, and apply the cover glass. If you now look at the hair, and if the acid has acted properly, you will see that the surface is covered by irregular patches of thin material which seems to be peeling off, like the skin from a snake that is shedding. This thin layer was the one that contained the character-

istic wavy markings.

Now, with a pencil or other instrument, gently press the cover glass against the slide. The pressure will cause the acid-softened hair to break down and separate. At last you see the true nature of the hair. It is made up of a bundle of long, slender cells, perhaps the thinnest cells to be found anywhere in the body. They are angular, in cross section, because of the pressure with which they were compacted. Careful examination of the soft, bulbous base of a hair reveals that the cells there are wider than in the main portion of the hair. As the hair grows out of its follicle in the skin, the cells shrink in size, and group together to form a compact bundle. It's much the same structure as would result if a bundle of rubber bands were forced lengthwise through a small opening, and

wrapped with a few layers of a tough, transparent skin, as they emerged.

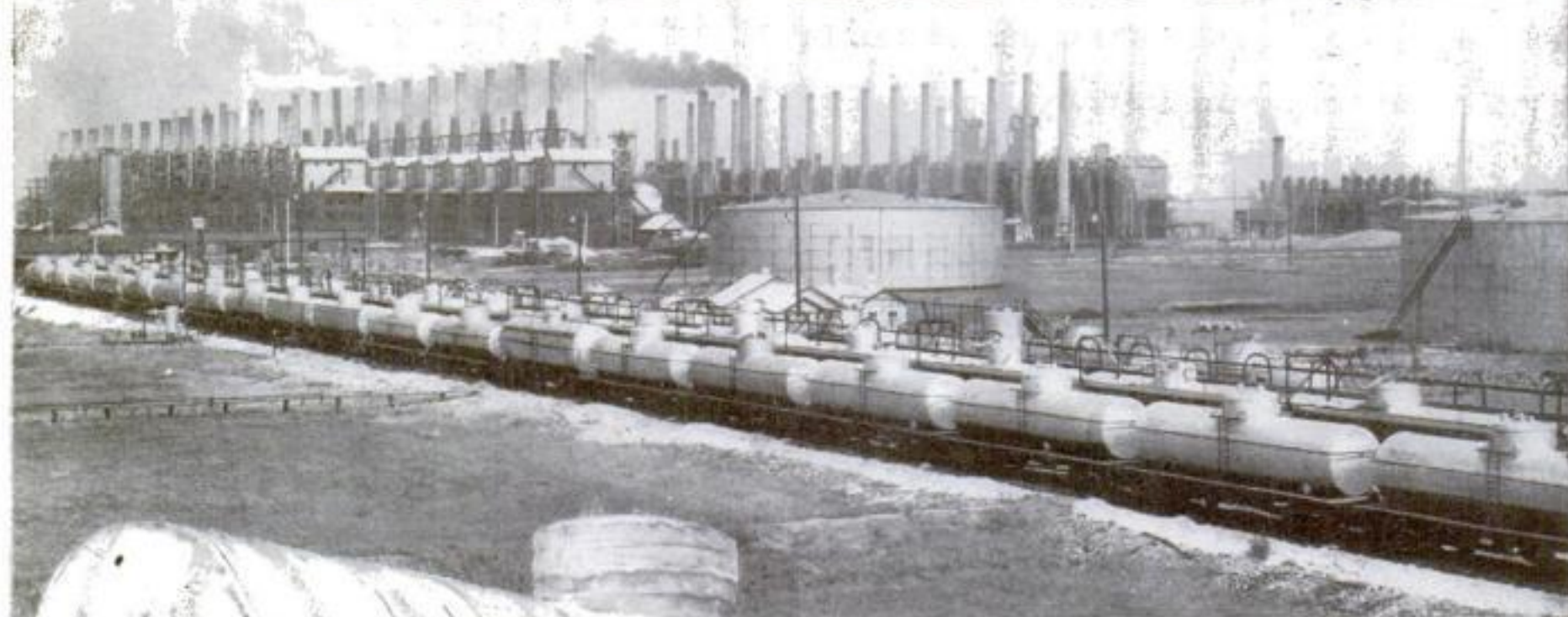
Examine the hairs of mice, cats, dogs, and sheep. You will see, for instance, that sheep wool has coarse surface markings; that it actually is rough-surfaced, like a file. This roughness is a valuable property of wool, because it makes possible the felting action whereby each strand becomes firmly interlocked with those surrounding it so that wool is much stronger than most cloth produced from smoother fibers.

One good source of hog bristles or of similar hairs is an old brush. By shaving thin layers from the wooden back of a brush, at a point where a bundle of bristles is embedded, you can produce excellent cross sections of the hairs. You will find that a hog bristle is not covered with a separate bark, as was the human hair. Instead, it seems to be nothing but a bundle of small fibers, with an open space in the center, surrounded by air-filled cells.

The microscopic examination of hairs is more than a mere pastime in certain branches of biology and allied sciences. An expert microscopist familiar with hairs, very often can identify definitely a piece of animal skin. Properly preserved remnants of prehistoric animals can be recognized by examination of the hair structure. Government food experts are skilled at identifying hairs of mice and of other small animals in butter, and in other food products.

A feather, strange as it may seem, is essentially a bird hair. That is, it does much the same *(Continued on page 102)*

Strange Cargoes Ride Newest TANK CARS



Tank cars are revolutionizing transportation for industry. Here two long lines of them are being loaded with oil at a large refinery. Left, applying rock-wool insulation to half-built car



SHUTTLEING back and forth over American rails are more than an eighth of a million tank cars. They play a little-known and often dramatic part in modern life.

Everyone knows how they carry milk and petroleum products. But few people realize that the papers they read, the clothes they wear, the auto tires they buy, the highways they ride upon, the candy and ice cream they eat, and even the soap with which they lather their faces and hands now are linked vitally to the work of these rolling containers.

In recent months, a score of novel applications have widened the scope of their usefulness. It is no exaggeration to say that the rise of the tank car is producing a revolution in transportation methods. Cement, sand, coal, fertilizer, lime and other solids, as well as liquids, now ride in them. Dynamite and high explosives travel thousands of miles in safety. Helium for blimps, melted asphalt for pavements, water for drought areas, shark oil for leather dressings, poison for insects, varnish for furniture—all travel the tank-car way. And, in Chicago, aquarium specimens from the sea are kept alive by salt water transported all the way from

the Atlantic Ocean in a special tank car!

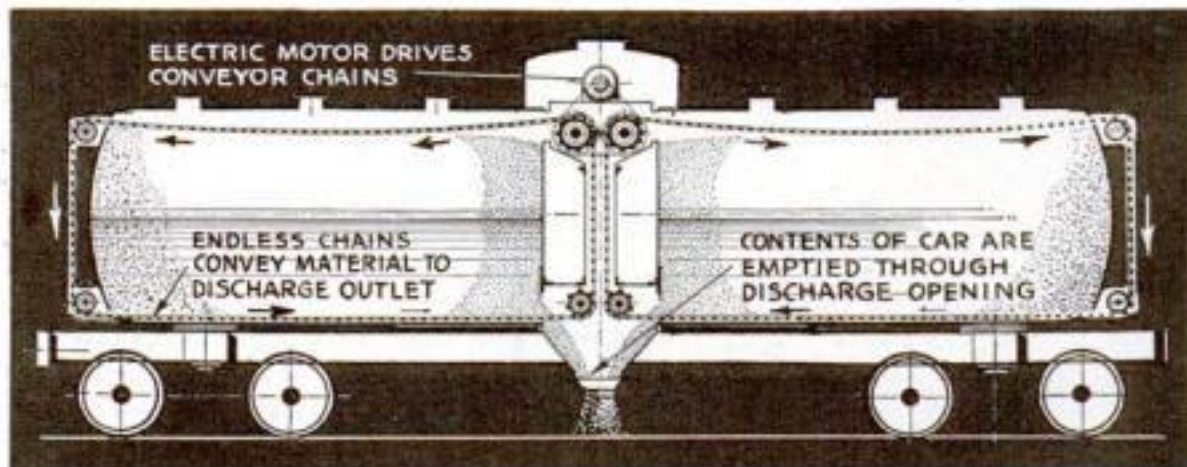
If the United States should become engaged in another war, tank cars as well as tanks will play a stellar role. One of the most recent innovations is the carrying of nitrated cotton, the basis of high explosives. Immersed in water, it is no more dangerous to handle than gasoline. And at the end of the journey it can be dried out and made as explosive as ever.

This promises an entirely new set-up in the manufacture of munitions. Instead of

every factory having to produce its own guncotton, the nitrated material can be manufactured at great central plants and shipped by tank car to the factories where specialized war materials are being prepared.

Another spectacular development is a new carrier that transports asphalt at a temperature of 500 degrees F. The insulation on the car keeps it molten for as much as four or five days while it is in transit. Shunted onto a siding near the scene of a paving operation, the car eliminates the necessity of heating the asphalt as it is laid and thus speeds up the work of construction. Because the molten material would damage wooden running boards if it dripped on them, special steel runways are often provided on these cars.

Candy manufacturers are seriously considering putting similar insulated cars to use for shipping hot chocolate coatings for bonbons in liquid form. At the present



In the conning-towerlike dome of this tank car for cement, lime, sand, flour, sulphur, and similar substances, is a motor that operates endless chains to discharge cargo through unloading hatch

By JOHN E. LODGE

time, they are saving thousands of dollars a year by transporting their sugar in solution in tank cars. Molasses has traveled this way for years, as much as half a million tons going by tank car in the space of twelve months. Grape juice, wine, beer, and even whisky are now riding in the big containers. In Canada, a large distiller has ordered a specially designed car to carry his product in bulk to American markets. It will haul almost \$100,000 worth of whisky at a single load.

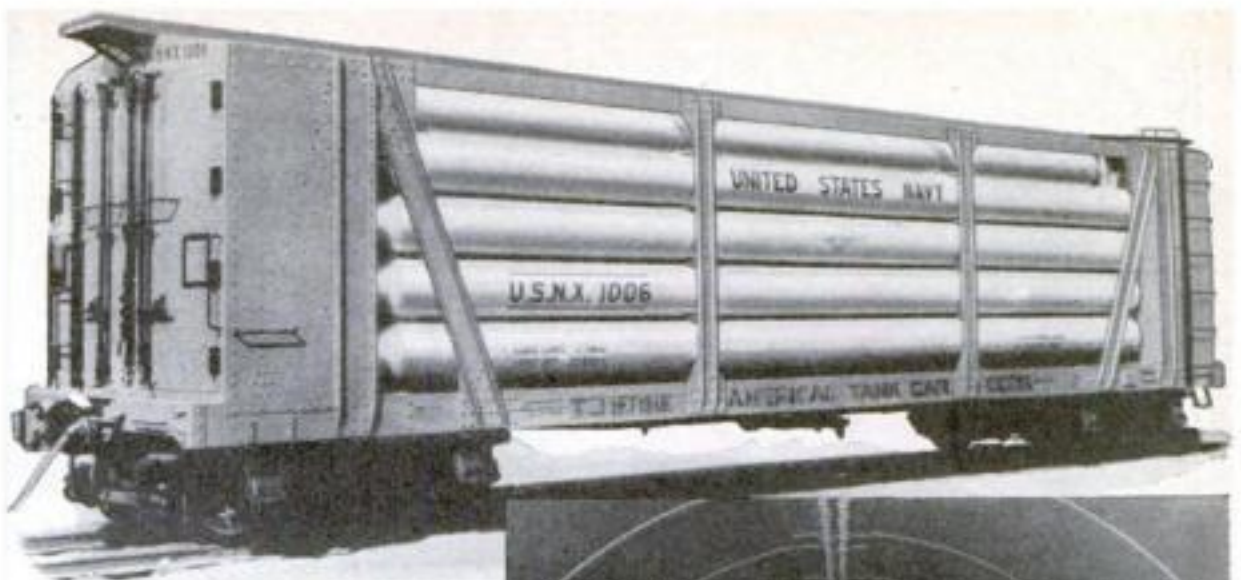
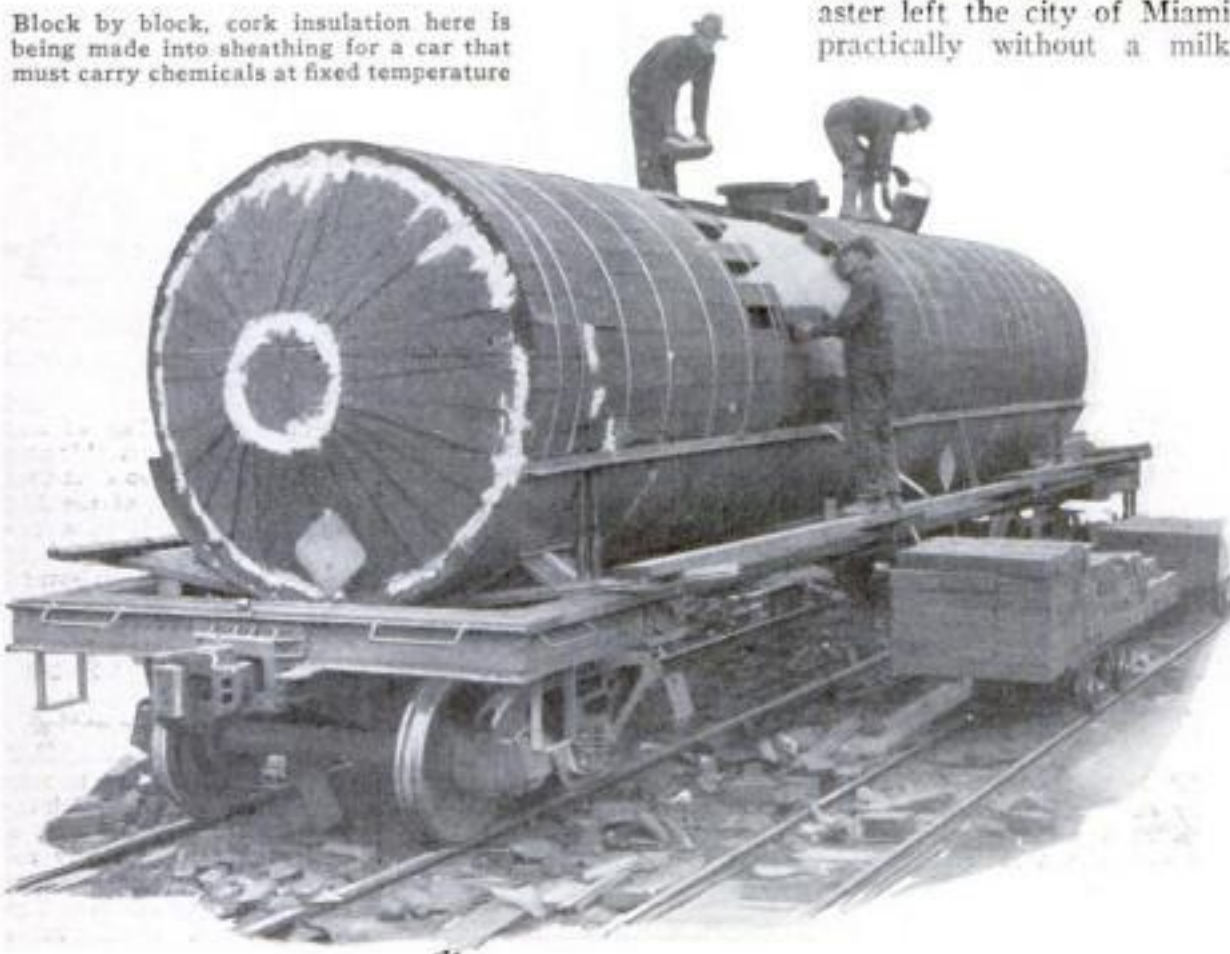
A few years ago, when there was a shortage of grapes in Canada, there was a bumper crop in California. Tank cars saved the day for the northern wine makers. They rushed a million gallons of raw grape wine from the vineyards on the Pacific coast to the wineries of eastern Canada. The transfer was made in less than a month.

Frequently, some such emergency sends the tank-car fleet racing from one part of the country to another.

Last winter, for instance, it saved Boston, Mass., from a fuel-oil famine. Ordinarily, this city received its gasoline and fuel oil by barge from the refineries of Providence, R. I., Bayonne, N. J., and Philadelphia, Pa. During midwinter, however, intense cold froze Boston harbor solid. Barges and tankers could not get in. Offices and homes faced the prospect of going unheated. Motor trucks did their best but they could meet but a small portion of the mounting demand. At this point, a fleet of tank cars, mobilized from eastern sidetracks, began pouring oil into the city. These insulated containers brought it hot from the refineries so it could be drained off without a moment's delay; thus the fires were kept burning until the harbor cleared.

A different type of tank car, a few years before, came to the same city's rescue in another emergency. Floods in Vermont, New Hampshire, and northern Connecticut, in November, 1927, cut off

Block by block, cork insulation here is being made into sheathing for a car that must carry chemicals at fixed temperature



At a pressure of 2,250 pounds per square inch, helium gas for the Navy's blimps is stacked in separate tanks on this special car

ninety percent of Boston's milk supply. Within forty-eight hours, long-distance calls to Chicago had started from six to eight milk cars a day on an express run from the great dairy farms of the middle west. They kept up this schedule for more than a month. Last summer New England paid back the debt. With the drought searing the Mississippi Valley dairy land, milk from New England hills kept up the supply at Chicago and other large cities of the region.

At present, sixty percent of the milk entering New York comes in tank cars. It speeds through the night in giant 6,000-gallon insulated bottles that ride the rails from neighboring states and from as far north as Canada. These glass-lined, cork-insulated cars are divided into two compartments, each holding from 3,000 to 3,600 gallons. Operating on high-speed schedules, they have changed the dairy map of the country.

The record run for a milk car was made at the time of the Florida hurricane in September, 1925. The disaster left the city of Miami practically without a milk



Hydrochloric acid will be transported in this metal cylinder. A technician is protecting its rivets with rubber

supply. When Red Cross workers, headed by Dr. Herman N. Bundesen, the Health Commissioner of Chicago, reached the stricken city, their first wire north was for milk.

Six thousand gallons were swiftly poured into a sterilized car on a siding in the heart of the Wisconsin dairy district. It headed south on a fifty-four-hour, 1,800-mile, non-stop run. The range of temperatures it encountered was sixty-six degrees. Yet, the milk reached the southern city only one degree warmer than it was at the start. The insulated car had kept it in perfect condition.

To take care of emergency calls, strings of reserve cars are kept at strategic points about the country. Most people will be surprised to learn that the railroads own only seven percent of the tank cars that run over their rails. The ninety-three percent are the property of private companies or of concerns that rent them out for private use. One of the largest of the latter is the General American Transportation Corporation, whose 60,000 leased cars have earned it the nickname, "The Pullman Company of Freight."

This organization maintains shops and storage tracks at Bound Brook, N. J., Pittsburgh, Pa., St. Louis, Mo., Kansas City, Mo., Chicago, Ill., New Orleans, La., Tulsa, Okla., Fort Worth, Tex., Los Angeles, Calif., and Buffalo, N. Y. The Buffalo plant alone has eight miles of sidetracks for concentrating cars for quick action in the eastern area.

One of the many times when the cars must be mobilized at high speed is when a boat arrives in port loaded with coconut oil from

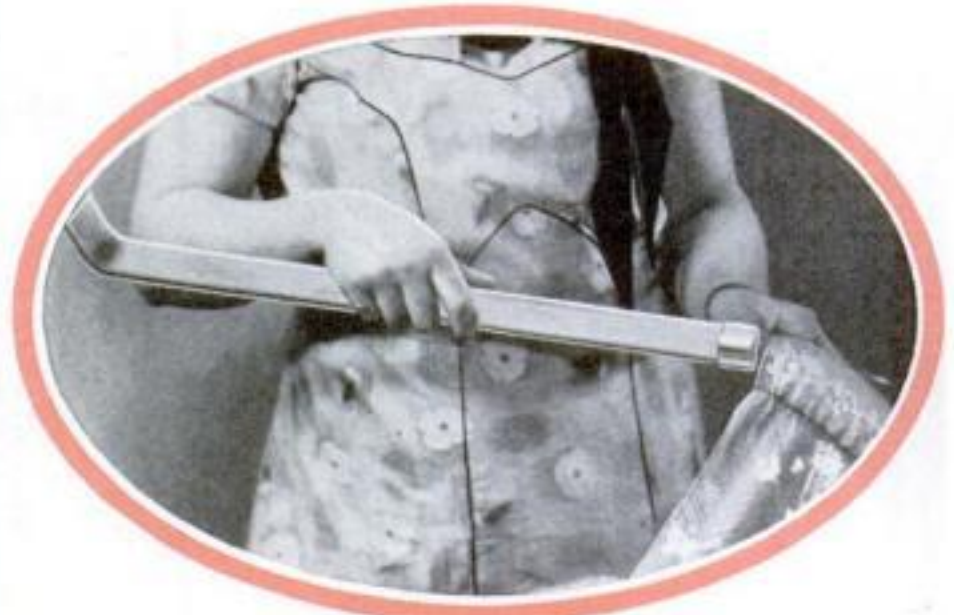
(Continued on page 114)

THIRTEEN NEW AIDS DESIGNED FOR THE Household



ASH RECEIVER ON ROLLING STAND

Illustrated above is a new noncapsizable smoker's stand that does not need to be lifted or dragged from place to place. It rolls on its ornamental wheels as shown. Mounted on the shaft is an ingenious cigarette container which is opened by sliding its cover up the shaft. Picture at right shows cigarette holder in use.



THIMBLE THREADS CURTAINS. Curtain rods can be run through hems quickly with the aid of the thimble illustrated. Slipped on the end of the rod, it covers the rough edges and guides the rod through the hem without tearing.



REVOLVING LIGHT SHADES

The lamp shade shown above fits on the small bulb of a table or decorative light. Balanced delicately on a wire pivot, it is turned by hot-air currents when light is on.



SUCTION CUP HOLDS HOT-WATER BAG. Any smooth surface, such as the tile wall of a bathroom, will support the new-type hot-water bag shown above. It has a rubber suction cup molded to it as an integral part. The usual hole for hooks is provided.



REMOVES DUST FROM VACUUM SWEEPERS

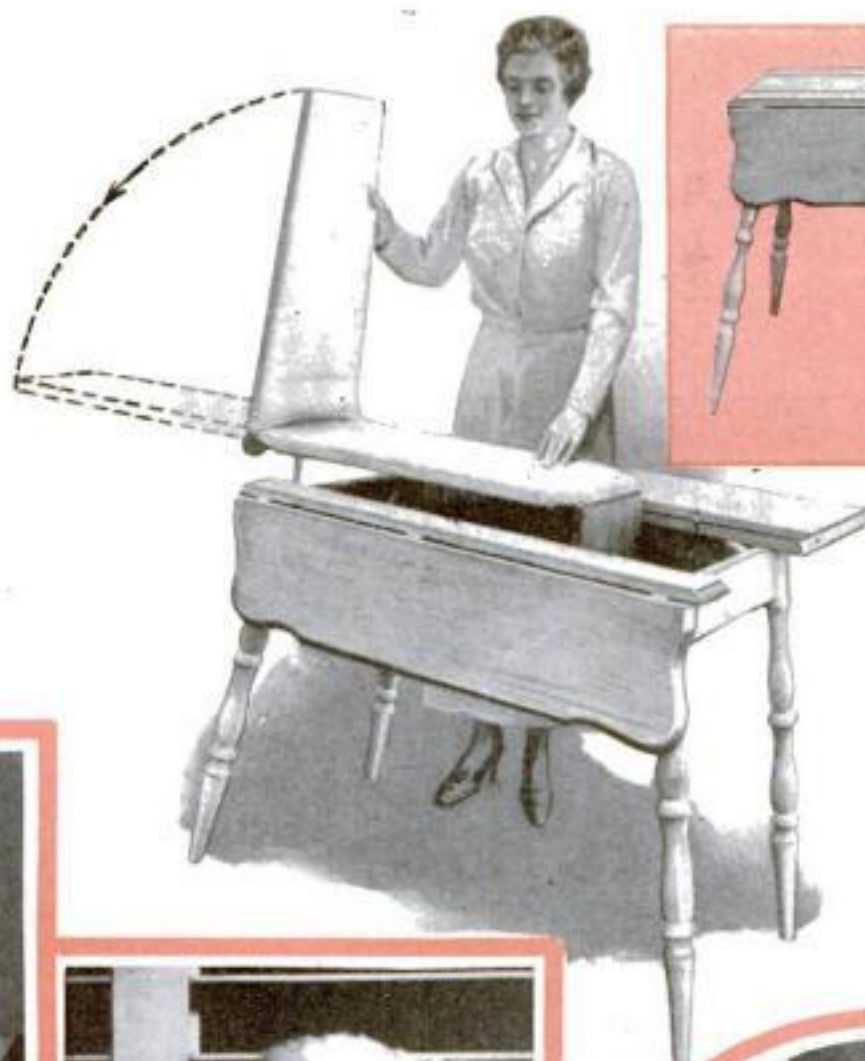
Attached to the upper end of the dust bag of any vacuum sweeper, this new device receives dust that is forced out of the bag and retains it in a porous fabric container which later can be burned.



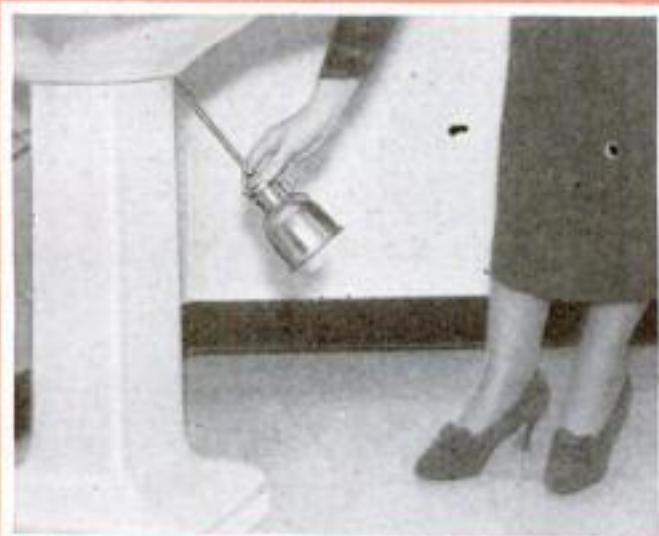
JAR CAP IS EASILY LOOSENED. By merely pushing a match stick into a hole in the cap, a housewife can easily release the vacuum in a new type of jar closure. The match opens a spring valve.



KIT FOR ETCHING GLASSWARE. With a cream marketed in collapsible tubes, monograms can be etched easily. Stencils are provided



IRONING BOARD IN TABLE. This combination ironing board and breakfast table is intended for kitchens in which space is at a premium. The hinged top of the table folds back, permitting the board to be opened



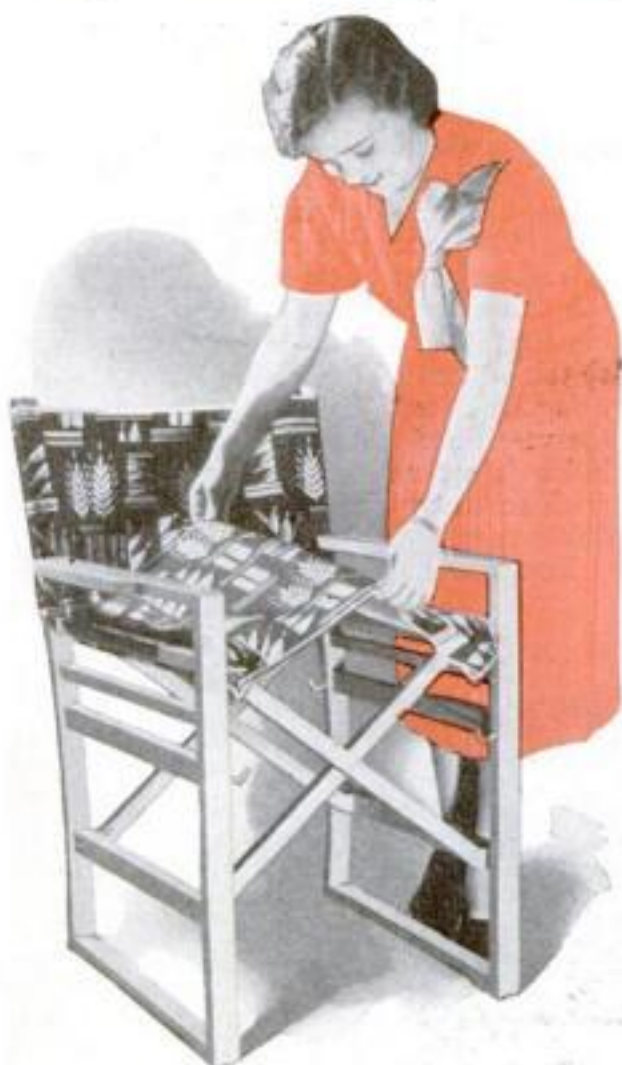
LAMP AIDS FOOT CARE. Ample light for trimming nails and otherwise caring for the feet is provided by a new lamp mounted on an arm which can be clamped to any convenient rigid object, such as a water pipe in the bathroom. The lamp has a metal shade



BRUSH FOR VENETIAN SHADES
The six wool fingers of the brush shown in the picture above are designed to clean the slats of a Venetian shade, making it possible to remove the dust from seven slats at a time. Long handles are available for shades too high to be reached with the brush alone



CARRIES OWN STAND. By pressing a lever on the handle of this electric iron, the user causes a spring stand to snap into place under it. When iron is lifted, the stand folds back



CHAIR FOLDS EASILY. This comfortable sun-room chair can be folded by simply pulling up the fabric seat. Constructed of birch, enamel finish makes it proof against the weather



SHOE-SHINING OUTFIT

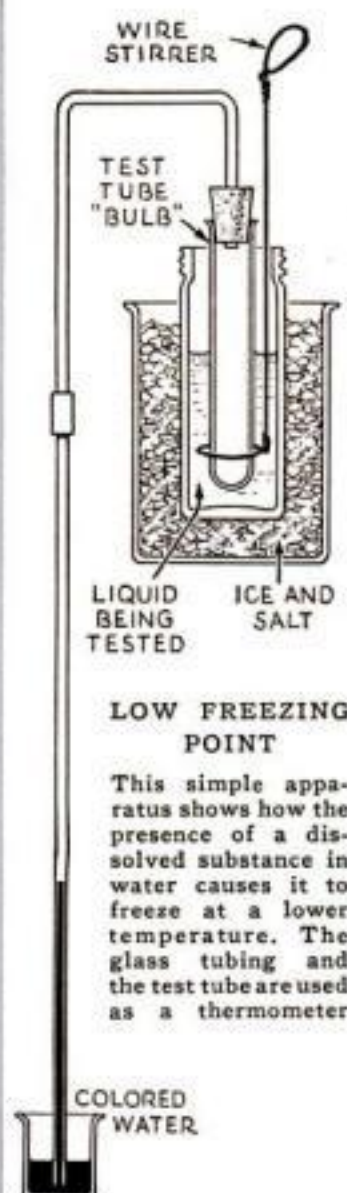
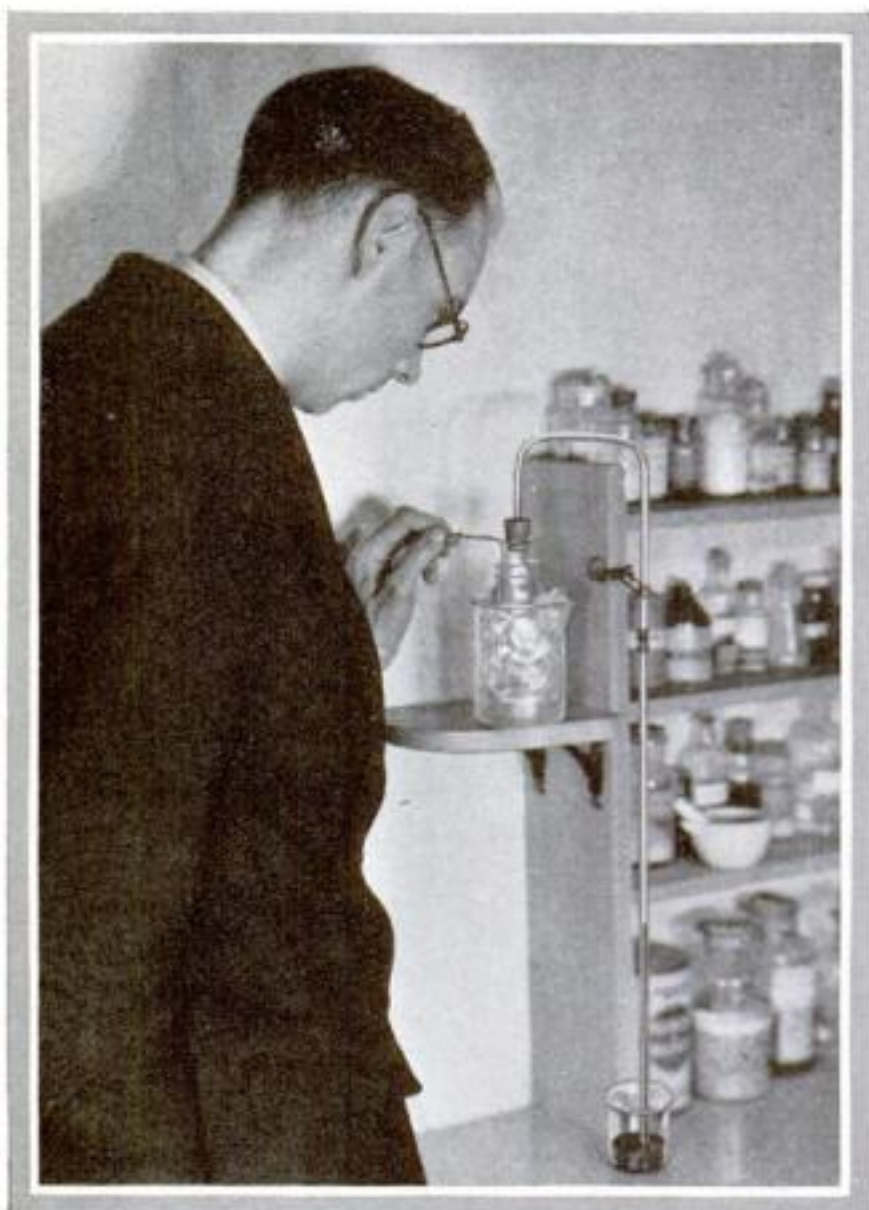
This adjustable shoe-shining apparatus has a metal frame that clamps to the seat of a kitchen chair. The footform has a sliding heel for size adjustments. At left, the outfit set up for use



Properties of SOLUTIONS

WHEN DISSOLVED, CHEMICALS ACQUIRE STRANGE
NEW QUALITIES OF INTEREST TO THE AMATEUR

By Raymond B. Wailes



LOW FREEZING POINT

This simple apparatus shows how the presence of a dissolved substance in water causes it to freeze at a lower temperature. The glass tubing and the test tube are used as a thermometer.

substance little influenced by temperature in its rate of dissolving. About thirty-five grams of salt will dissolve in 100 cubic centimeters of ice-cold water. If you heat the water to the boiling point, only four grams more, or a total of thirty-nine grams, will dissolve.

In contrast, a substance like potassium nitrate, or saltpeter, shows a marked response to temperature, when you are making a solution of it. About thirteen grams will dissolve in 100 cubic centimeters of the cold water, but as much as 246 grams—about nineteen times as much—will dissolve in the same amount of boiling water. You can verify this by actual test. The quantities mentioned need not prove alarming, for the amounts of chemical and water can be reduced proportionately. After the experiment, you can let the solution evaporate. Because the potassium nitrate will crystallize out, you will be able to use it again for other experiments.

To make a substance dissolve as rapidly as possible, the best way is usually to grind it fine, to use a warm or hot solvent—ordinarily, water—and to stir it constantly. When the chemical is finely ground, more of its surface is exposed to the solvent than when it is not ground. Stirring prevents the solution at the bottom of the vessel from becoming strong or saturated, so as to hinder the substance in dissolving farther.

A convenient aid in making solutions is a perforated funnel, suspended in the solvent. The solute, or chemical to be dissolved, is placed in this conical basket. As the substance dissolves, the solution, being heavier than the solvent itself, sinks to the bottom of the vessel. Pure solvent, being displaced, rises along the sides of the vessel and enters the funnel. A circulation is set up that constantly presents fresh solvent to the chemical, and rapidly dissolves it.

You can easily make such a funnel

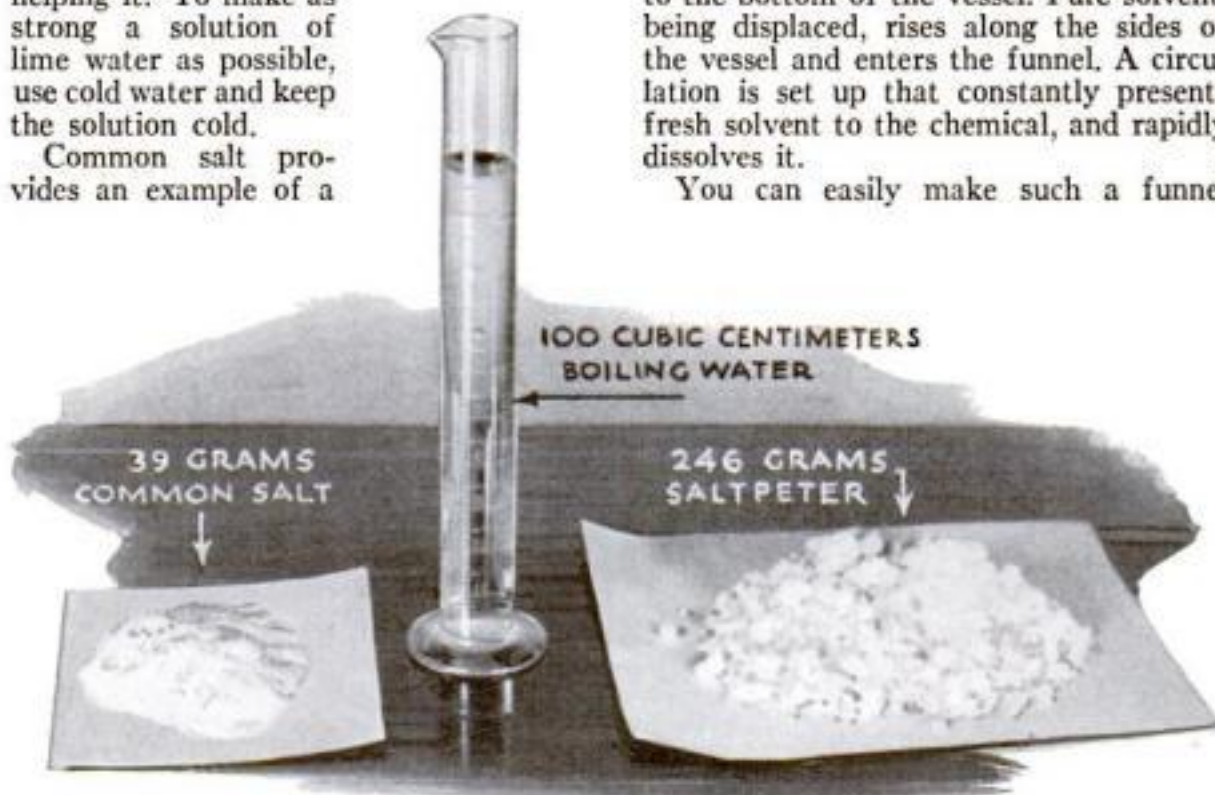
MAKING UP a solution of a chemical is like giving a tool a handle. Once dissolved, a substance is in a convenient form to be manipulated into interacting with other reagents, and performing a variety of tricks that it would otherwise refuse to do. Consequently, when you mix two solid substances like copper sulphate and borax, or sodium borate, they seem wholly inert to each other; but if you mix *solutions* of the two, the story will be different. At once you observe that something brand-new has been formed—copper borate, which becomes visible as a cloudiness or precipitate.

Just how solutions behave is worth investigating, for they are called for in most of the tests you will perform in your home laboratory. Such tests are known as test-tube or "wet-way" experiments.

Probably you have observed already the surprising difference in the relative ease with which various chemicals dissolve. Calcium chloride, for example, dissolves quite readily in water. But in making so simple an alkaline liquid as lime water (calcium hydroxide), by dissolving lime (calcium oxide) in water, it seems as if the lime will never disappear, because the capacity of water for dissolving lime is decidedly limited, as you will see.

Heating the water used helps to dissolve a chemical, generally, but not always. In making lime water as just described, using hot water actually hinders the process instead of helping it. To make as strong a solution of lime water as possible, use cold water and keep the solution cold.

Common salt provides an example of a



The difference in solubility between common salt and saltpeter is disclosed by an easy experiment

Shown in Home Experiments

from sheet celluloid, using one of the newer transparent cements to seal the lapped edges of the cone. If you prefer, you may make your own cement by dissolving celluloid in acetone or amyl acetate. Such a cone will prove to be handy in the home laboratory; it will not be damaged by most water solutions.

When solutions of two different substances interact, you can often predict what the resulting products will be. When you mix solutions of copper sulphate and sodium borate, in the manner briefly described at the outset of this article, you will get copper borate, which forms a precipitate because it is insoluble in water. Another product is sodium sulphate, which is soluble and therefore remains in solution. You will note that the two metals—in this case, copper and sodium—simply have changed places with each other; this interchange is a typical result of a "double decomposition" reaction. There are exceptions, however. If you mix aluminum sulphate and sodium carbonate, you will get sodium sulphate, but not aluminum

carbonate, as you might expect. The white, jellylike precipitate that is formed is aluminum hydroxide.

A curious phenomenon observed in mixing certain solutions is called the "common ion effect." This results from the property of many chemicals by which they separate into different parts, called "ions," upon dissolving. When sodium chloride dissolves in water, sodium ions and chlorine ions are formed. Similarly a solution of hydrochloric acid contains hydrogen ions and chlorine ions. If you mix strong solutions of sodium chloride and hydrochloric acid, both of which contain chlorine ions, some of the salt will be precipitated. Strong hydrochloric acid added to strong solutions of potassium chloride or barium chloride also will precipitate these chemicals from their solution, because they also contain the chlorine ions. Similarly, strong potassium hydroxide solution causes potassium chlorate to precipitate from a strong solution; the potassium ions in this case are those common to both. Mixing substances containing common ions will not invariably produce a precipitate, however.

Some compounds form what are called "supersaturated" solutions, from which they crystallize in a peculiar manner, as you can demonstrate by an interesting experiment. Place some crystals of sodium thiosulphate (photographer's hypo) in a test tube, and heat them until a solution is formed. The crystals readily dissolve in their own water of crystallization. The tube should be shaken and rotated during heating, to distribute the heat evenly and to prevent the glass from cracking. Let the solution and the tube cool. The solution will still be a liquid. Now carefully pour a supersaturated solution of sodium acetate (made by placing crystals of so-

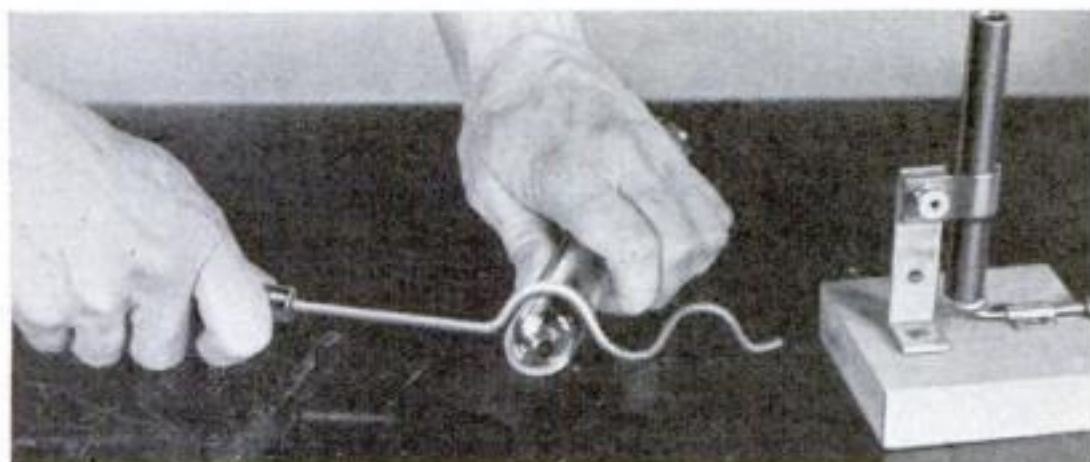


A double experiment in crystallization. A layer of supersaturated solution has been crystallized

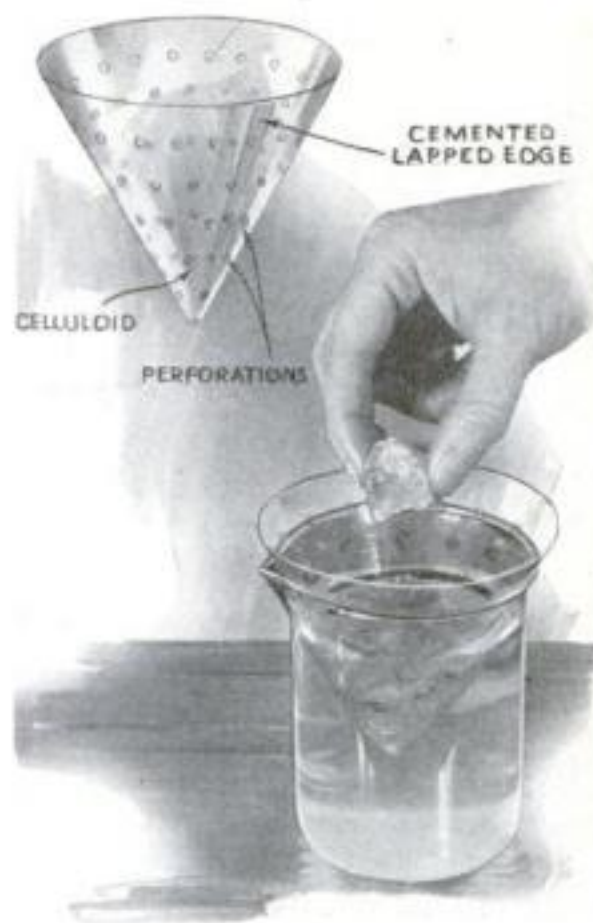
RING SNAP CUTS GLASS TUBING AND BOTTLES

AN IRON ROD, bent to the shape of the object handled, provides a convenient way of cutting glass tubing, bottles, and jars. First scratch the glass with a file all the way around, where the break is to be made. Then heat the iron red-hot and apply it to the mark. The tool

shown was shaped to accommodate the smaller sizes of material, and has four bends for objects of various diameters. Others of larger size may also be made permanent additions to your home laboratory equipment. A tool handle is fitted to the shank of each, for convenience in using.



How the ring snap is held in cutting tubing. The four bends take tubes of various sizes



A perforated cone of celluloid being used to dissolve lumps of a chemical without heating

dium acetate in about one-fourth of their weight of water, and heating) on top of the liquid hypo, taking pains that the two solutions do not mix. Drop a small crystal of hypo into the test tube. It sinks through the two solutions and comes to rest at the bottom of the tube.

Immediately a strange thing happens—the solution of hypo itself crystallizes, the crystal growth commencing at the surface of the foreign crystal. Now drop into the tube a crystal of sodium acetate. It will settle through the sodium acetate solution and come to rest upon the previous crystal growth. Being in contact with the upper solution, it will similarly crystallize the latter in a very few seconds, and the entire contents of the tube will have become a mass of crystals. Place your hand on the tube and you will note a decided warmth, characteristic of this phenomenon, and emanating from the crystallization, not from the tube itself, for it had been allowed to cool.

Often the foregoing experiment fails because of spontaneous crystallization of the hypo solution before the hypo crystal is added. This premature crystallization generally is caused by foreign matter such as dust or lint in the solution. If it occurs, purify the hypo by dissolving it in water, filtering it, and allowing it to crystallize in a warm place. Keep it free from dust. The pure crystals obtained in this way may be used successfully in the experiment.

Note that in this experiment the hypo crystal did not cause the sodium acetate solution to crystallize. The experiment shows that supersaturated solutions crystallize in this way only upon contact with crystals of the same substance, or, at least, crystals of the (Continued on page 112)

Question: How big was the largest gold nugget ever found? J. K. Olio, Ark.

Here's the Answer



A.—A VERY strong man could hold the famous Welcome Nugget in his two hands, but he would have to be "hefty", for the nugget, the largest recorded, weighed 182.9 pounds. It was, roughly, one sixth of a cubic foot in size, and might be represented by a cube measuring five inches on each side. It would fit comfortably in the crown of a soft felt hat. The Welcome Nugget was found in the Bakery Hill Mine, Ballarat, Victoria, Australia, in 1858, at a depth of 180 feet. It weighed 2,195 troy ounces, and was ninety-nine percent pure. At that time it was valued at \$40,000. The next largest was the Blanche Barkley, found in South Australia. It weighed 149 pounds. It is to be noted, in visualizing the size of these nuggets, that a cubic foot of gold weighs 1,204 pounds.

ble fly, however, (*Stomoxys calcitrans*), is a biting fly that is very similar in appearance to the house fly. It has a long, slender snout with which it pierces the skin.

Snow in Summer

Q.—WHEN I was a boy, I used to talk with my great-grandmother, who was nearly 100 years old. I recall distinctly that she used to tell a story of snow falling in the "hot months" in the United States a long time ago, when she was very young. Perhaps you can tell me whether there is any kind of fact behind her story.—S. P., Louisville, Ky.

A.—IT is entirely possible that your great-grandmother could recall the year 1816, in which snow fell and frosts were felt in all the northern part of the United States then settled, during each one of the summer months.

A Military Mascot

A. B. L., DENVER, COLO. The Irish wolfhound is the mascot of the famous regiment of Irish Guards and parades with them on state occasions. He is led, in leash, by a drummer boy in full dress uniform. You are right in your assumption that the wolfhound is one of the oldest breeds of pure-bred dogs. At one time, however, he became extinct, but was re-bred.

Where the Bee is Essential

T. L. S., SEATTLE, WASH. Of all the nations of the world, Ethiopia (Abyssinia) is most dependent upon the bee. Honey forms a most important part of the daily diet of Ethiopians.



The Egg As Message Bearer

Q.—A FRIEND of mine who served in an allied intelligence service during the war hinted to me that secret messages can be written on the inside of an unbroken egg. Is this true? If so, how is it done?—H. D. C., Washington, D. C.

A.—THE MESSAGE is really written on the outside of the shell, with a solution of alum

and vinegar. The egg is then boiled for fifteen minutes. The writing disappears from the shell, but when the egg is opened, the message is found, clear and legible, upon the white of the egg, inside.

An Old Superstition

H. W. B., ALLENTOWN, PA. Although the whippoorwill is one of the most charming of birds, and his song one of the most melodious, a superstition that he presages ill luck has grown up around him, probably because his song is so plaintive. Another probable cause for the superstition is the comparative invisibility of the bird. He is timid, flies only by night, and is therefore seldom seen.

An Indian Name

R. L. E., ATLANTA, GA. The word Siwash, as used to describe the so-called "Siwash Indian" is incorrect. The name is really Salish. Anthropologists believe the Salish Indians came across the Bering Strait from Asia, and are related to the Mongols.



Renovating a Straw Hat

A. L. L., ST. LOUIS, MO. If your straw hat has become soiled by wear, sponge it with a weak solution of tartaric acid and water. Fasten the hat with pins to a flat board, so that it will keep its shape while it is drying. This method, however, should be used only on hats of natural (uncolored) straw. The hat can be pressed afterward with a moderately hot iron. Any straw hat that has become limp can be stiffened by the use of gum-water.

The 'Bourne of Lost Ships'

Q.—IS THE Sargasso Sea merely legendary?—T. E. M., Portland, Me.

A.—THERE are Sargasso Seas in the Atlantic, Pacific, and Indian oceans. They are areas of the ocean's surface enclosed by great floating masses of sargassum, or gulfweed. The legend that the Sargasso Sea holds ancient abandoned vessels in an endless embrace has long since been found untrue, but smaller fragments of floating wreckage are likely to get caught in the sargassum weeds and be retained by them for years. The nearest Sargasso Sea lies between Bermuda and the Virgin Islands.

Brightening a Turquoise

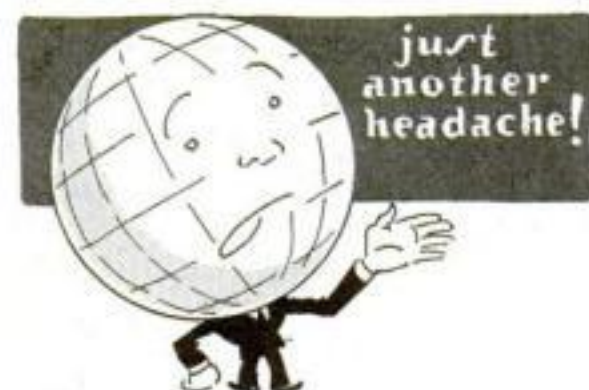
R. S. W., PORTLAND, ORE. The blue of the common turquoise can be restored by dipping the stone into a solution of sodium carbonate. The oriental turquoise does not fade. The finest of these stones come from Persia.

Ever Try to Count 'Em?

G. L. L., ANN ARBOR, MICH. A locomotive puffs four times for every revolution of its driving wheels, or 800 times a minute at fifty miles an hour.

The Heat of the Earth's Core

S. P., TEL-AVIV, PALESTINE. Science now believes that the center of the earth has a temperature of 50,000 degrees Centigrade, and is subject to a pressure of 50,000,000 pounds to the square inch. (Continued on page 111)



The End of the Seasons

Q.—WHAT would happen if the world were suddenly to stop moving?—R. M., Greenwich, N. Y.

A.—SUCH a disaster is inconceivable in the universal scheme of things. However, one result would be the complete remaking of the world's economic system; the sequence of seasons would end, crops would fail on the permanently dark side of the world; populations would migrate to the bright side. The failure of only one crop—grass—would mean starvation.

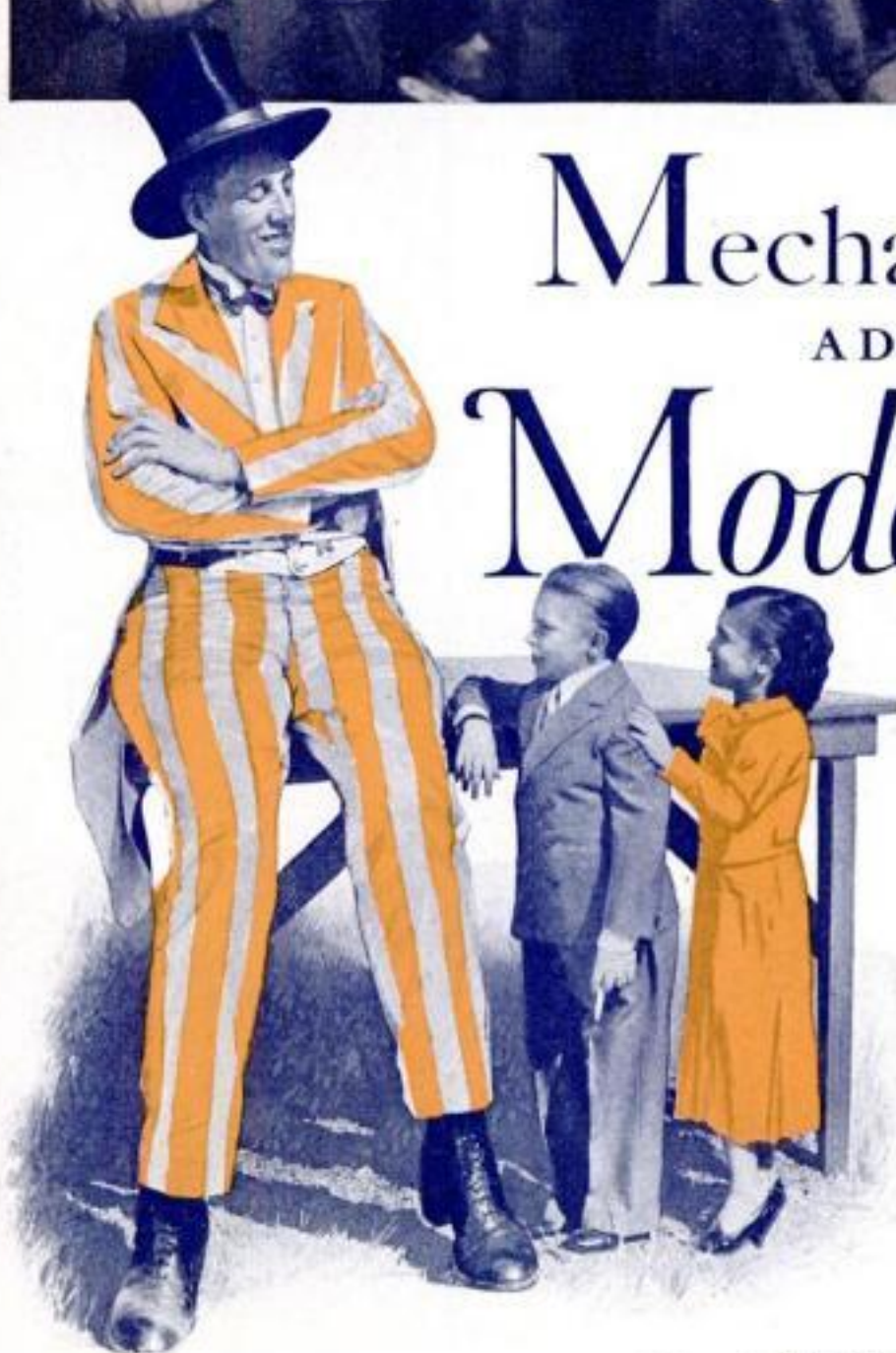
Hanging a Thermometer

B. B. C., DULUTH, MINN. If you mount your thermometer on the wall of your house, see to it that the instrument hangs at least an inch from the wall, so that it will not register the temperature changes coming from within. Hang it on a sheltered porch.

One Bites; the Other Doesn't

Q.—DO HOUSE flies bite? N. R., Casey, Ill.
A.—THE insect known as the house fly (*Musca domestica*) does not bite because it has no mouth parts capable of biting. The sta-

The Loop-O-Plane, one of the new thrill rides that have transformed the carnival into an itinerant amusement park. Streamlined cars, attached to the ends of great metal arms, are swung in twenty-foot vertical circles. Like all other carnival equipment, this device is easily knocked down and reassembled



Mechanical Fun-makers

ADD NEW THRILLS TO

Modern Carnivals

MORE than a hundred American carnivals are taking to the road. Rushing over rails or rolling by motor truck, they are heading away from winter quarters. In the world of outdoor shows, the spring push is on.

With thrill rides, hooplas, barkers, glittering midways, and mechanical laugh-getters, they are bringing fun and excitement to thousands of Americans. Like roving amusement parks, they move from town to town in truck fleets or in special trains with as many as half a hundred cars. Amplifiers, lighting effects, and new motorized thrillers play a vital part in this modern version of the old-time carnival. For, much of its success is based upon the innovations of science and the ingenuity of inventors.

This season, two new nerve-tinglers are being added to the rides. They are the Loop-the-Loop and the Loop-O-Plane. In the first, a battery of drum-shaped cages, each holding four passengers, spin in vertical loops within a huge framework of steel. In the second, great metal arms swing streamlined cars

in twenty-foot vertical circles. Both are ingeniously designed so they can be assembled or knocked down with a minimum of effort. The Loop-the-Loop, towering higher than a two-story structure, can be packed for transportation in a single wagon eight feet wide and twenty feet long. And, the 3,500-pound Loop-O-Plane can be assembled by two men in an hour and a half and can be taken down and packed in sixty minutes.

Another ingenious time-saver is a new five-wagon merry-go-round. When the carnival reaches its location, the wagons are bolted together to form a single unit and provide the foundation upon which circle the forty-eight wooden horses and two chariots. Later, when the next jump is made, the wagons are unbolted, the merry-go-round is broken up into five separate parts and rolled onto flatcars for the trip to the next town.

Unlike the circus, the carnival is seldom owned outright by one man. The "show owner" has the merry-go-round and some other attractions. He makes arrangements for transportation and electricity and rents the lots. Then he subleases space to concessionaires at so much a foot or at a flat rate for the week. Separate indi-

viduals operate most of the shows and booths. They may travel the whole season with one carnival or they may jump about from one outfit to another. A week's stay in each lot is the rule, and the concessionaires know "two lots ahead" where they are going to be later on.

The cost of a carnival's "reader," or license to operate, is usually based on the number of rides it has. For, the rides form the heart of the carnival. Hundreds have been devised by American inventors—the Razzle-Dazzle, the Heyday, the Leaping Lena, the Ridee-O, the Whip, the Caterpillar, the Tilt-A-Whirl, the Airplane Swing, the Dodgem, the Waltzer, the Flying Turns, the Lindy Loop, and a host of others. Of them all, three continue year after year to lead in popularity. They are the merry-go-round, the Ferris wheel, and the Whip.

Because it always heads the list, the merry-go-round is known among carnival folk as The First Ride. Both it and the Ferris wheel have been known for generations. Until 1893, the latter was called the pleasure wheel. It got its present name from the engineer, George W. G. Ferris, who designed the immense wheel for the Chicago World's Fair. The Whip is a comparatively recent innovation. It was put on the market in 1914 by the Coney Island manufacturer, W. F. Mangels. The cars, running on an elliptical track, are given an extra snap as they round each end.

Practically all carnivals carry the Big Three rides. One, the famous World of Mirth shows, has fifteen different thrillers, including a triple Ferris wheel and a \$15,000 caterpillar. In addition, it carries baby Ferris wheels, chairplanes, and merry-go-rounds for the smaller children. One of the trends of the carnival world at present is toward small rides

for the amusement of younger children.

As an illustration of how a big modern carnival operates, let's follow the World Of Mirth on a season's tour.

The \$250,000 organization, employing 470 people, rolls from town to town on a special train of fifty all-steel cars. Each of the flatcars holds four wagons, fourteen by twenty feet. The carnival equipment is packed in the wagons, hauled to the cars and rolled up into place. A ten-ton endless-tread tractor pulls the conveyances. On several occasions, the tractor has hauled sixteen-ton wagons through mud almost up to their hubs. Huge rubber tires on the wagons prevent damage to streets and curbs.

Between May 1 and November 11, the carnival travels approximately 10,000 miles. It knows six weeks ahead where it is going. The first dates are in the South. When summer has come to northern states, most of the one-week stands are made as "still dates," that is, the carnival appears under the auspices of a lodge, church or local organization, donating fifteen percent of the proceeds to it. After the middle of August, the fair season is in full swing. It is then the carnivals make their money.

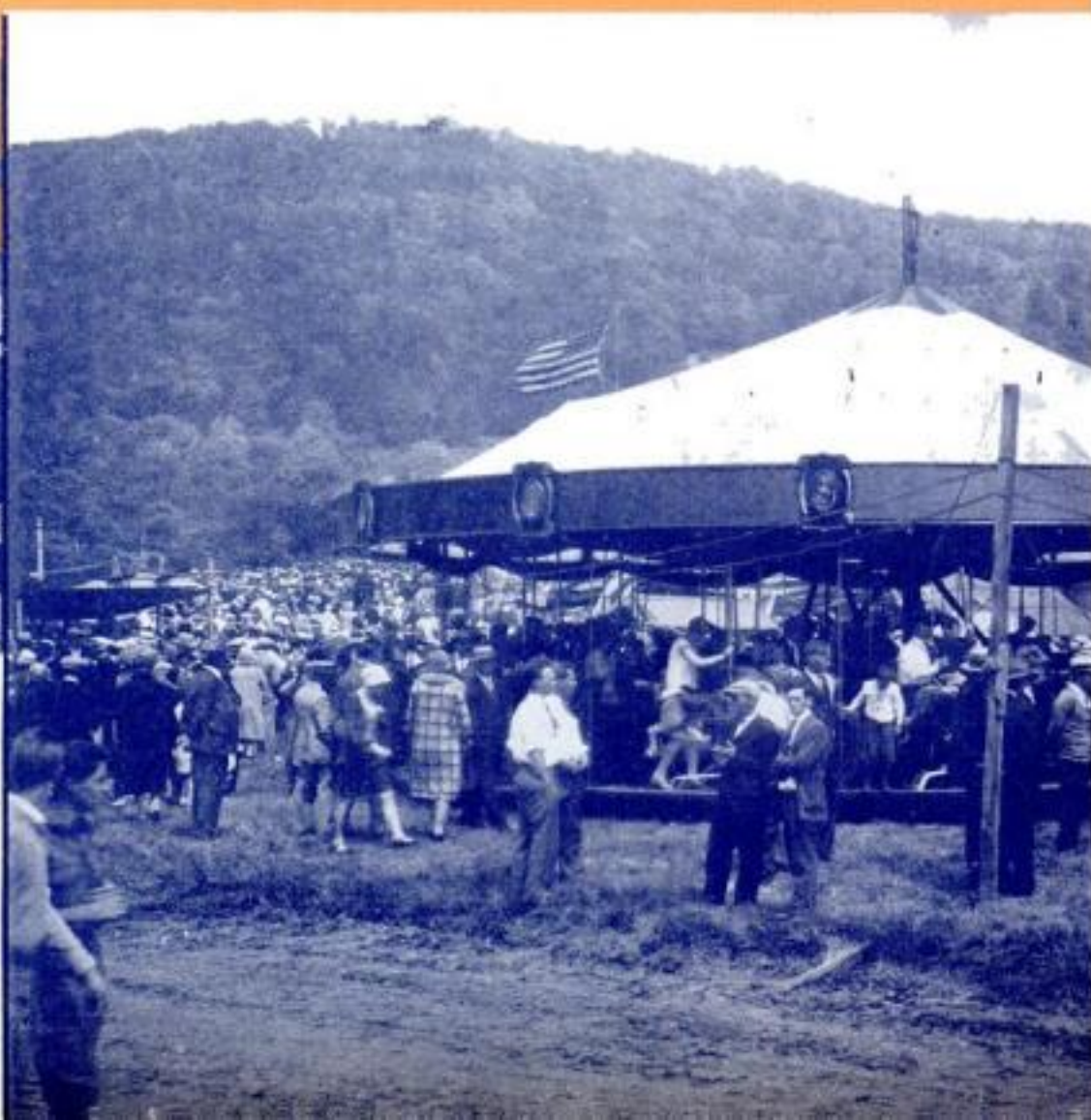
The printing bill alone, for posters and handbills, may run to between \$9,000 and \$10,000 for the season. Two weeks before the carnival reaches a town, a pair of paper trucks, each carrying two billposters, arrive. Under the direction of the advance advertising man, the men cover billboards and telephone poles with announcements of the forthcoming attractions. Counting the handbills, 5,000 pieces of paper are frequently left in a single town.

One week ahead of the show, another advance man arranges for electricity, laundry and butcher service. Two days before, the regular publicity man descends on the local papers. Then comes the "Twenty-Four-Hour Man." He goes



All the sensations of looping the loop in a tiny airplane can be enjoyed for the small sum of one dime, on this carnival attraction. New rides are introduced each season

A typical carnival lot is seen at the right. The merry-go-round and Ferris wheel are the perennial favorites. The small tents house freak shows, games, and other concessions



over the lot and stakes out the ground so that every tent has its place and there is no confusion when the wagons arrive from the train. The smallest plot the carnival can use is 400 by 800 feet.

At the center of the midway, he locates the transformer wagon. It holds eight transformers and from it wires run to every tent. All that is necessary when the show arrives is to set up the transformer wagon and connect it with the local supply of current. Some of the cables running from these transformers are more than an inch thick. Through this nerve center, in one season, passes from \$8,000 to \$9,000 worth of electricity.

The nine acres of canvas carried by the show costs about \$18,000 and lasts three seasons. It is under the supervision of a boss canvasman. He remains awake nights, alert for danger. Once, last summer, it came in an unexpected manner shortly before midnight.

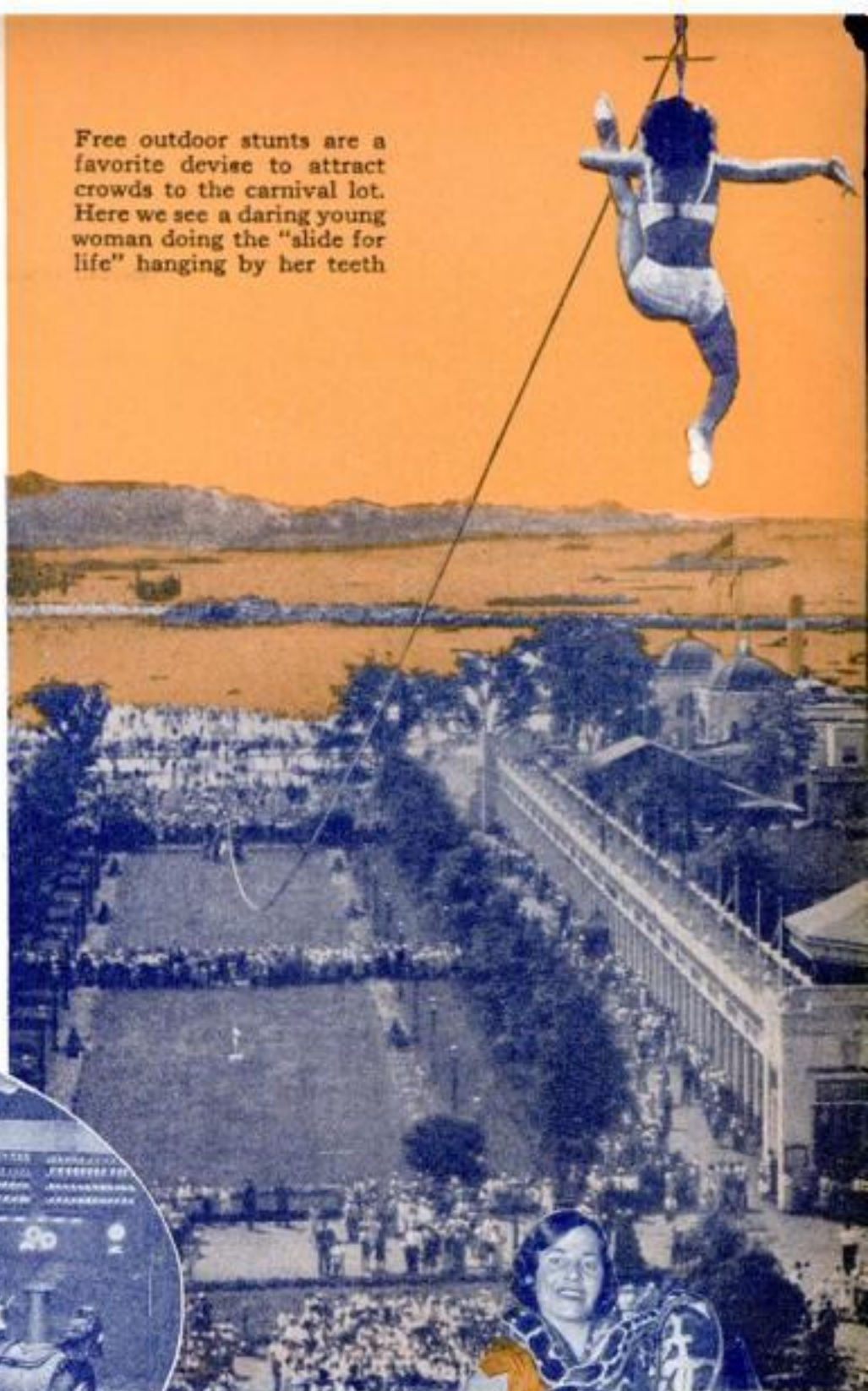
The carnival was playing at a North Carolina fair. One of the exhibits, a short distance from the midway, caught on fire. Sparks poured into the sky and drifted over the carnival tents.

All hands were routed out and for nearly an hour 200 men lay along the canvas with pails of water, extinguishing sparks as they showered down.

Another time, at South Chicago, Ill., a terrific storm struck with such suddenness that every tent was leveled and the Ferris wheel was battered to the ground. Under ordinary circumstances, as soon as a wind storm appears, the Ferris wheel is braced with guy ropes and the seats are removed as quickly as possible. This leaves only the framework, which offers comparatively little resistance to the storm.

Far different from the World of Mirth were the "mud shows" of the early days—the horse-and-wagon outfits that

Free outdoor stunts are a favorite device to attract crowds to the carnival lot. Here we see a daring young woman doing the "slide for life" hanging by her teeth



The fat man takes a ride on the miniature railway. A modern trend among carnivals is to provide more small rides for younger children to enjoy



A snake charmer of the carnival midway. Side-show attractions and freaks provide a large part of the lure of the bigger shows

traveled about the country in the last years of the nineteenth century. Later, carnivals took to trains and, more recently, to motor trucks. Today, the majority of smaller carnivals are completely motorized, traveling about as truck caravans that roll thousands of miles each season.

The 1893 Chicago World's Fair started the present-day carnival. Millions of people had read about the curiosities and wonders of its midway, called the Highway of All Nations, who had not been able to visit the fair. When the exposition

an arrangement, last year, one famous fat lady cleared \$300 in a single week. Most of the freak shows are "grind joints." That is they play continuously during the hours the carnival is operating.

Since the depression, most of the crooked games and rigged apparatus which usually are associated with carnivals, have disappeared. Known to the profession as "skin stuff" or "working strong," the use of such dishonest mechanisms is waning rapidly. Many of them were ingeniously simple. Take the familiar "Test Your

Strength" machine, in which a 2,000-pound blow with a sledge-hammer rings the bell.

Unnoticed by the crowd, the crooked operator governed the apparatus by means of a small toe lever. As the weight streaked up the wire toward the bell, with all eyes on it, he would flip over the lever and cause the wire to go slack.

Against this added resistance, even a giant could not drive the weight to the top. When the operator demonstrated to the crowd how easy it was, he kept the wire taut.

Again, there is the old stand-by "Ring the Can!" The simplest shift of the "grifters" was to weight one side of the ring so that it always fell at an angle and thus decreased the size of the opening. Whenever the shill, or helper, worked his way to the front of the crowd and laid down a dime, he was given unweighted rings. With them, he could easily win one of the prizes and thus stimulate trade.

Another way in which the rings were doctored was to squeeze them until they were slightly elliptical in shape. The pedestals on which the "flash," or best merchandise, was placed were made one thirty-second of an inch larger than the narrowest opening of the elliptical rings. Consequently, ringing the pedestals was an impossibility. The pedestals holding the cheap trinkets, or "slum jewelry", were slightly smaller, so that occasionally a customer won an inexpensive prize.

One old-time carnival man told me how sharpers preyed on sharpers a decade ago. Into the crowd around a "well flashed-up" booth, a stranger would shove his



Even blasé New York likes the carnival, as is proved by the photo at the left, in which the spire of the Chrysler Building is seen framed in a Ferris wheel. Below, an acrobat is shown high in the air on a portable trapeze which can be folded up when the show takes to the road



closed, showmen carried the midway attractions to the country. After that, carnivals increased rapidly in number. In 1902, there were seventeen; in 1906, forty-four; in 1912, fifty-five; in 1918, seventy-two; in 1922, eighty-nine; and today there are 120.

In front of every tent the barkers, or spielers, dwell on the marvels inside. They have regular parts to play. The "grinder" shouts at the passing crowds; the "opener" gives a set speech to the "tip" or crowd gathered about the entrance, and the "doorman" pantomimes.

The freaks, who play an important part in every big carnival, draw salaries which range from \$25 to \$125 a week. A human skeleton, or "cigarette fiend," usually gets only \$25; a fat man, \$30; and a fat lady as much as \$50. A bearded lady may run up to \$75 and a first-class giant draws \$80. Midgets get from \$50 to \$60. The highest-paid freak last season was a four-legged baby. Its parents received in the neighborhood of \$125 a week for thirty weeks.

Sometimes, the freaks get a percentage of the intake of their particular shows. This is usually ten percent. Under such



way to the front and buy a couple of dollars' worth of rings. Without attracting any attention, he would pull each ring from an oval into a perfect circle. Then he would proceed to ring one flash prize after another, while the proprietor writhed helplessly. By the next day, the stranger would have come to terms with the proprietor and, as part owner of the booth, he would be squeezing the rings back into their elliptical form and exhorting the crowd to step up and try its luck.

Another well-known carnival game consists of swinging a ball suspended on a string in such a way it knocks over a ten-pin on its return stroke. When the ball is suspended directly above the pin, the feat is impossible. Only by violating a cardinal law of physics could it be accomplished. Yet, the operator would nonchalantly swing the ball and knock over the pin half a dozen times in succession. His spiel ex- (Continued on page 116)



Kit contains all materials for simple refinishing jobs

Cabinet Refinishing Kit

GOOD for removing scratches from furniture as well as from radio cabinets, this new kit contains an assortment of fine sandpaper, cleaning and rubbing oils, a felt rubbing pad, stick shellac of various colors, an assortment of stains, a small spatula, and a camel's hair brush. Packed in a compact leatherette case, it provides all the materials necessary for simple refinishing jobs. The instruction sheet accompanying each kit makes it easy for the beginner to obtain results like those of an experienced cabinet-maker.

Set Units Mounted in Electric-Clock Cases



Electric clock case at right contains a one-tube receiver

METERS, oscillators, tube testers, short-wave converters, remote controls, and microphones are only a few of

the things that can be mounted attractively in spare electric-clock cases. A complete one-tube battery receiver, except for the batteries, has been built into the one illustrated. The tuning condenser is mounted just under the top of the case, with the tube and the plug-in coil in a horizontal position beneath it. Molded cases of this type can be obtained at reasonable cost from dealers in radio supplies, and provide mountings of trim, professional appearance which will fit in well with the furnishings of any room in which they may be used.

Compact New Outlet Takes Five Connectors

QUINTUPLETS seem to be the order of the day, and the latest is a five-way convenience outlet designed to replace the tangle of plugs and wires found on most amateurs' benches. Flat plugs provided with the unit make it possible to cram five connectors into a space less than three inches long. Old-style round plugs also fit this new-type receptacle and the new flat plugs fit all standard old-type receptacles. Being of standard size, the new

multiple outlet fits any standard outlet box and requires only two simple connections. The new outlet is shown below.



Five-way convenience outlet contrasted with the old method

A Page of New Ideas for the Radio Fan

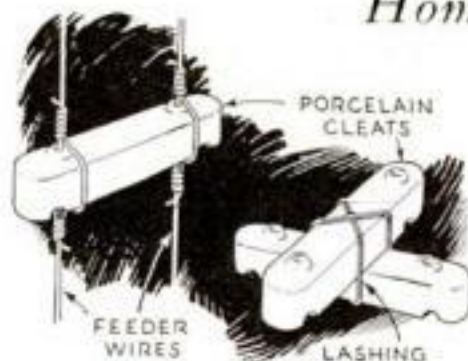
Novel Pocket Chart Finds Trouble

FOR THOSE who doctor sick radios, a new and useful pocket trouble finder is now available. It is a seven-page table of possible sources of trouble, classified by symptoms and locations. By swinging the cover page around, the user can line up the symptoms against the location, and find instantly where to look for the trouble. This "trouble tell-tale" lists six types of symptoms and seven locations, thus cross-classifying 275 possible trouble sources.



Symptoms and locations give source of trouble

Homemade Doublet Insulators



ORDINARY porcelain cleats, of the type used for open-wire lighting circuits, make very efficient spreaders for short-wave doublet antennas and feeders. The antenna or feeder wires are best secured to the insulator by first passing one wire through each hole and then binding them with short lengths of thin wire, as shown. Transposition blocks also can be made simply by crossing two such cleats and lashing them together.—E. B. L.

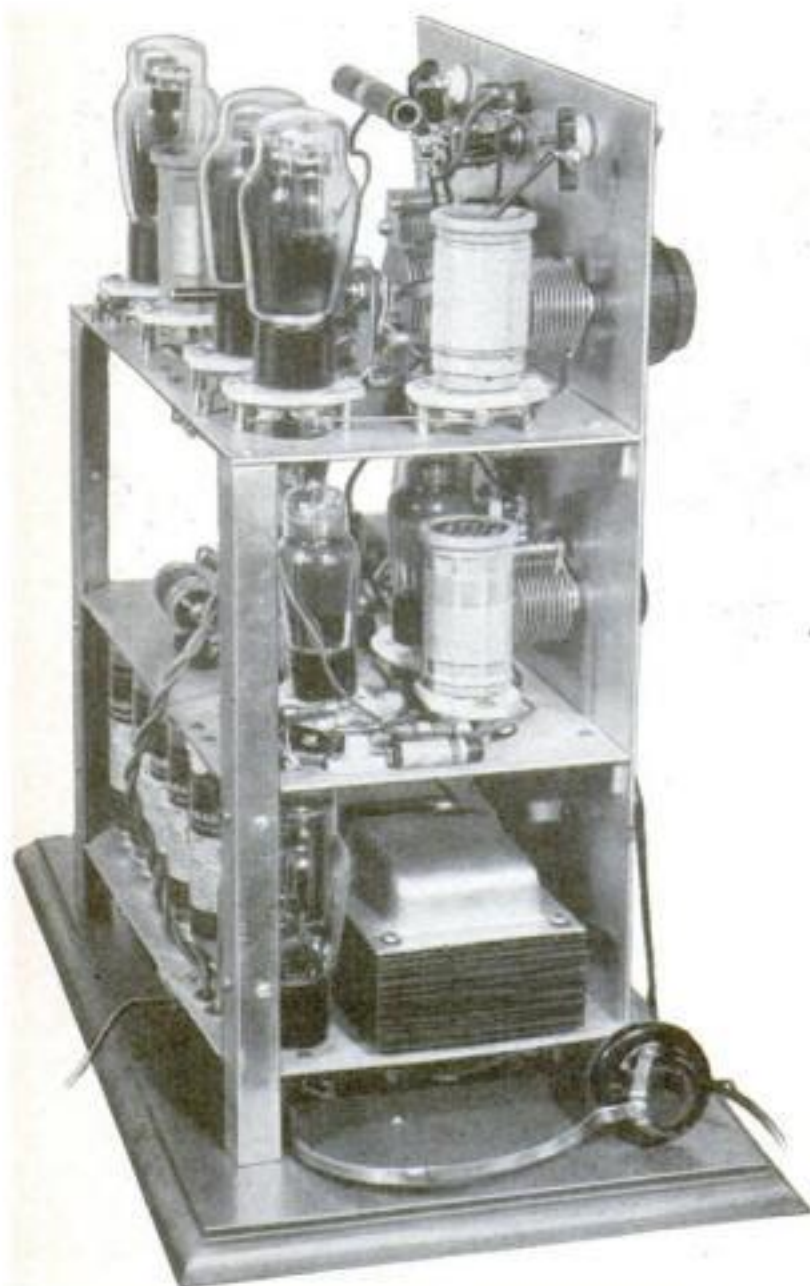


Simple phonograph attachment for any radio set

Phonograph Attachment

ANYONE can now play phonograph records through his radio receiver and loudspeaker. The new phonograph oscillator shown above does the trick with a minimum of connections. This device is described by its manufacturers as a miniature transmitter, which "broadcasts" recorded music and speech to the receiver. Actually, it transmits over a wire connection, but it does transmit the same sort of a signal as a radio impulse, and eliminates all necessity for changes in the wiring of the receiver itself. It may be installed in almost any set in a few minutes time; the only connections necessary are made by slipping special adapters over the prongs of the receiver rectifier tube and the heater prongs of any other tube in the receiving set.

Portable Station



This view shows the arrangement of the station on three shelves. At the top, the transmitter; in the middle, the receiver, and at bottom, the power supply

IF YOU need a portable transmitter and receiver as well as permanent units for your "shack," why go to the trouble and expense of building two complete stations? The compact, thirty-five-pound outfit illustrated has all the advantages of both. It is not elaborate, bulky, expensive, nor hard to build, yet it has all the features of a dependable eighty-meter station with an output that exceeds thirty watts.

In designing this combination unit, efficiency, compactness, economy, convenience, quality, and output all were considered. As a result, it gives creditable performance both at home and in the field, and may be set up ready to go on the air within a few minutes. Although basically a 110-volt outfit, designed for regular alternating-current use, it can be powered by a six-volt battery used in conjunction with any commercial vibrator power unit, when 110-volt lines are not readily available.

For convenience, the complete outfit is assembled on three aluminum shelves, fastened one above the other to one-inch aluminum angles. The top shelf holds the transmitter, the middle the receiver, and the lower the power supply. Each unit is entirely separate from the other; the necessary interlocking power leads are made to small stand-off insulators.

Because it was designed for portable use, no trick circuits were used in the transmitter.

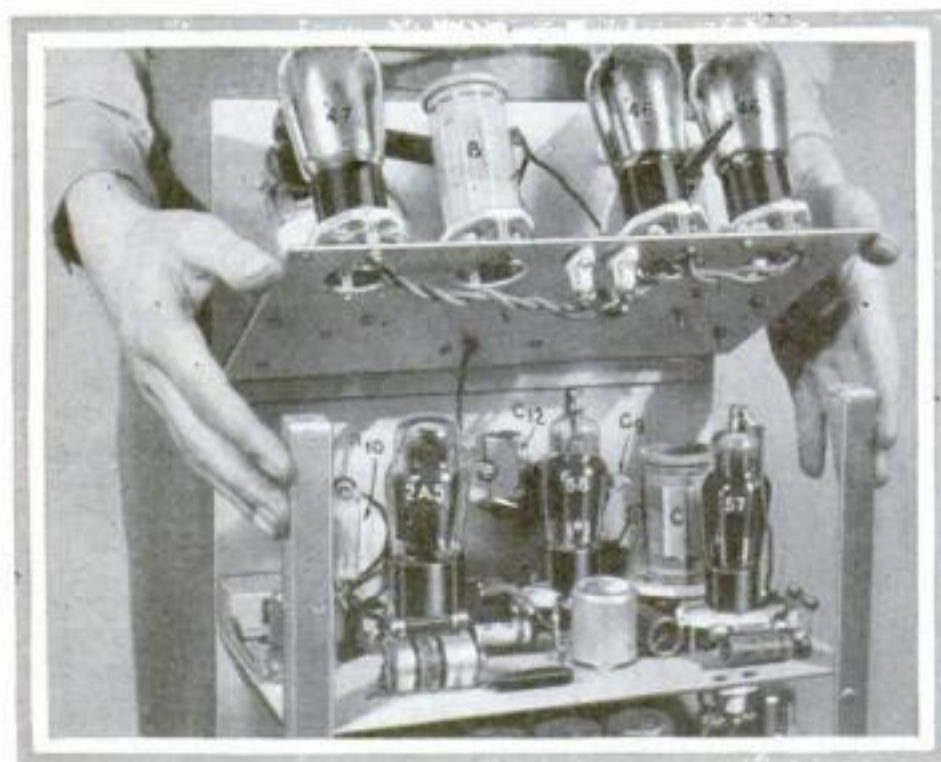
It consists simply of a '47 crystal (eighty-meter) oscillator and a capacitively coupled amplifier made up of two '46 tubes connected in parallel in an ordinary neutralized circuit. The coils are wound on groove-ribbed forms for air spacing. The oscillator coil (B) is a standard four-prong eighty-meter receiver coil with the primary winding removed while the amplifier coil (A) is a six-prong form wound with thirty-two turns of number eighteen wire tapped at the tenth turn for the antenna connection and a neutralizing winding consisting of twelve turns of number twenty-two wire.

There should be no deviation from the sizes specified in the transmitter design, as the specifications were chosen only after careful experiment proved them to be the best for the circuit. The coupling condenser C_{11} is exceptionally important. Any difference in the capacity at this point will prevent the '47 tube from oscillating.

A search through the diagram also will reveal a double-pole, double-throw switch. This is used to connect the plate milliammeter either to the oscillator or to the amplifier plates. This system is better than using two separate closed-circuit jacks and inserting a plug into the required jack when a reading is required.

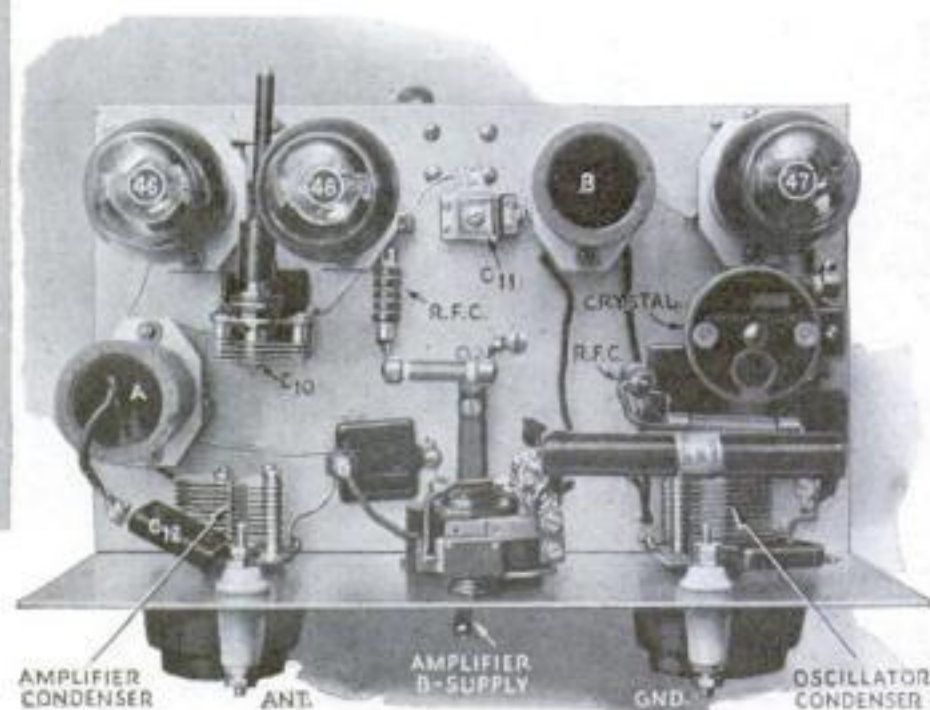
In developing the receiver, the main consideration was to provide a short-wave circuit that would give foolproof operation. The result is a three-tube receiver having every essential for long-distance amateur reception. Yet, it can be constructed easily by the beginner and is low in cost.

Its outstanding features are high radio-frequency, sensitivity, simplified circuit design, band-spreading, smooth regenerator control, and ease of tuning. The three tubes used in the circuit



Here the transmitter shelf has been removed from the assembly rack, to show the simple and compact placing of the various receiver parts

At right, top view of the eighty-meter transmitter. The switch at the center of the panel is a single-pole, single-throw unit used to control the B-supply for the amplifier



*Though Light and Compact,
This Inexpensive Set Is
Complete and Can be Used
Permanently in Your Shack*

By
J. B. CARTER

are a type '58 in an untuned radio-frequency amplifier, a '57 as a regenerative detector, and a 2A5 as the audio amplifier. Bandspreading is provided by a small, three-plate condenser connected across the 140-mmf. main tuning condenser. Plug-in, six-prong coils are used (C) and consist of a primary, a secondary, and a tickler. These coils are commercial units similar to those used in the transmitter.

The last, but not the least important, part of the station is the power supply. To reduce the cost, a single power unit serves both the receiver and the transmitter. The power transformer high-voltage winding provides 450 volts each side of the center tap, and is rated to carry 200 milliamperes. It also has three separate filament windings; one five-volt winding for the 5Z3 rectifier tube and two 2½-volt windings for the filaments in the transmitter and receiver respectively. As the output voltage is around 500 volts, the first two filter condensers are connected in series and, to distribute the voltage evenly across the series condensers, 50,000-ohm carbon resistors (two-watt) are shunted across each condenser. A single-pole, double-throw switch serves to connect the supply either to the transmitter or to the receiver, as desired. This



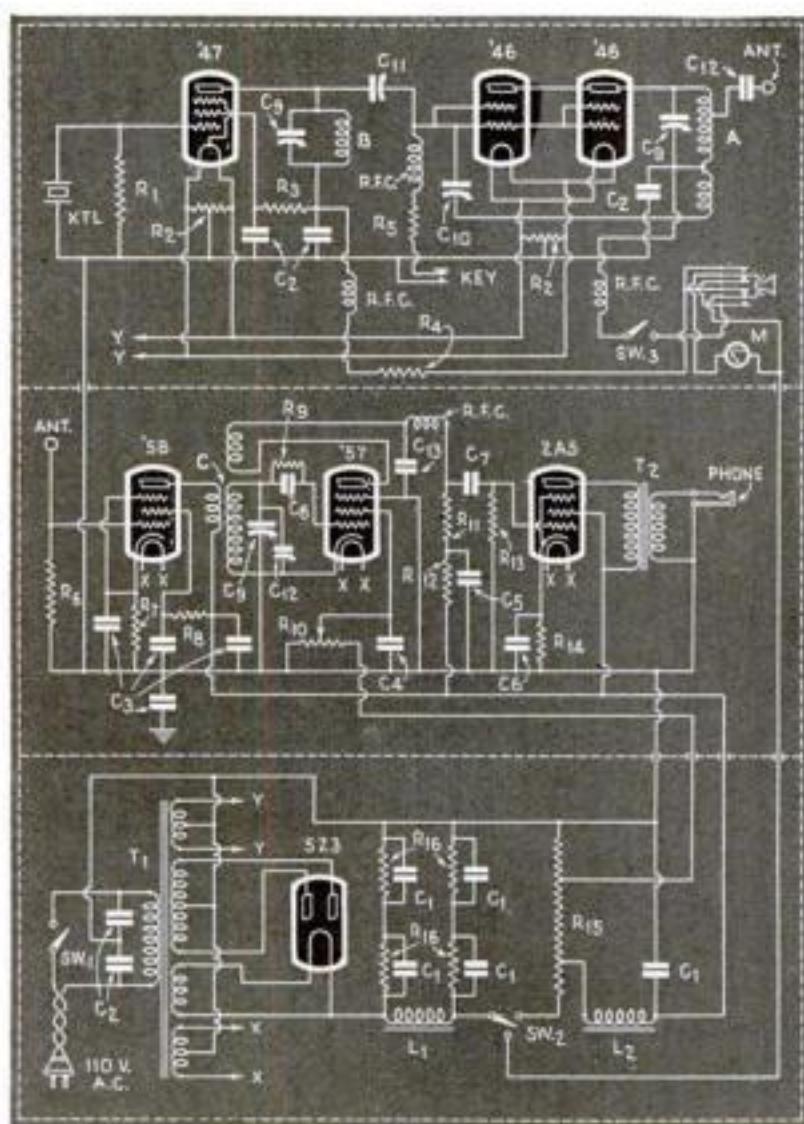
The station in use. When it is to be carried, a front cover is put on, to protect the panel

switch should be of the self-shorting type.

In studying the diagram for the power supply, you will observe that the bleeder is used only when the power switch is thrown into the receiver position. For this reason, the switch should be turned to receive when the power supply is first turned on, to prevent any possibility of blowing the filter condensers while the tubes are heating.

Tuning the transmitter is a simple procedure if certain instructions are followed step by step. A small neon glow lamp is the only instrument needed. First, the

milliammeter on the front panel should be switched into the oscillator plate lead, the switch (SW₃) in the amplifier plate supply lead placed in its "off" position, and the switch SW₂ thrown over to the transmit position. This process connects the B-supply to the oscillator. Then, hold the neon bulb near the plate end of the oscillator coil and adjust the oscillator plate tuning condenser until the lamp glows with maximum brilliance. At this point the milliammeter should read between forty-five and sixty-five milliamperes. If rotating the *(Continued on page 99)*



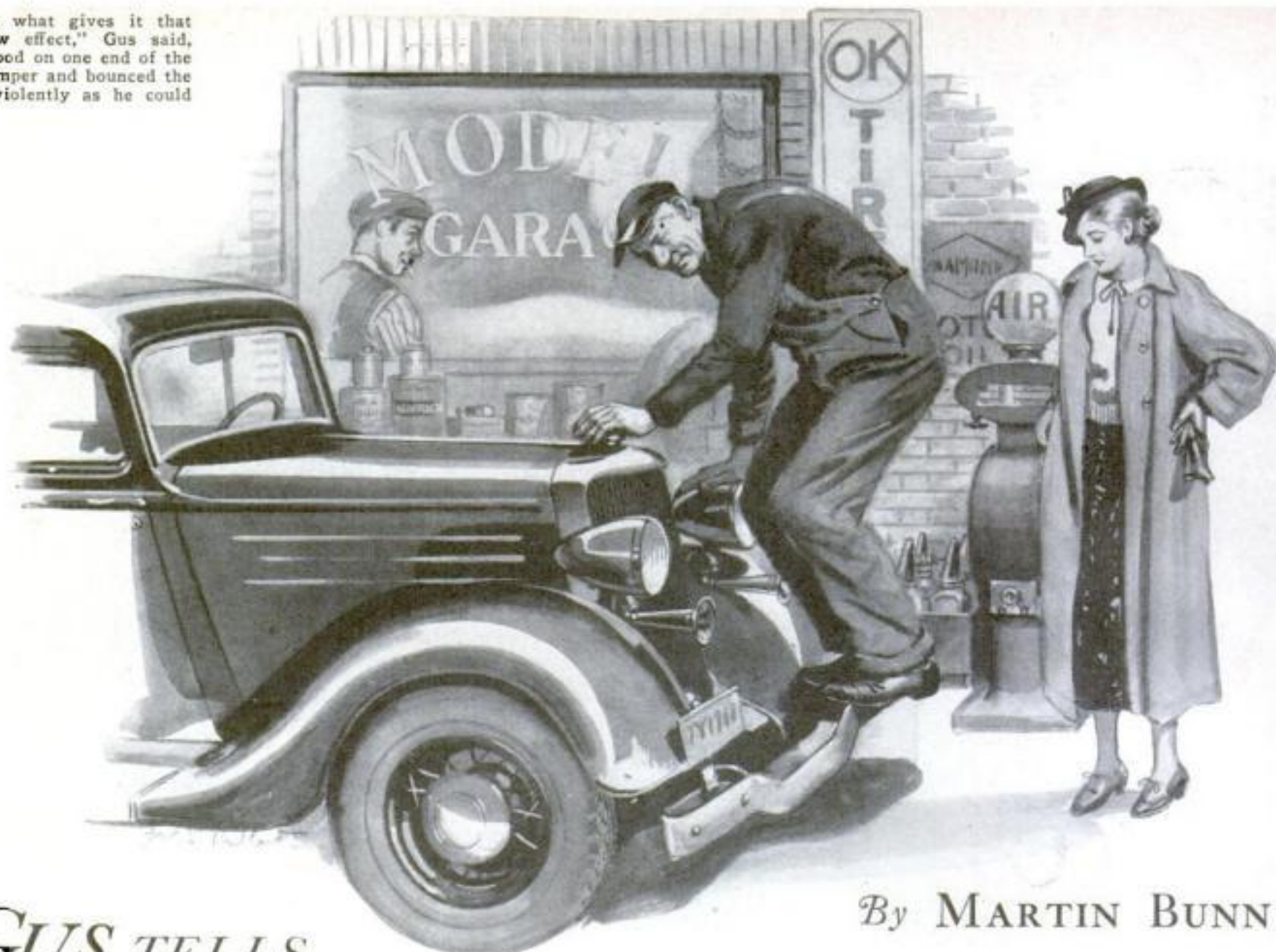
TRANSMITTER
Note location of transmitter antenna coil, and the manner in which stand-off type insulators are used to make interlocking connections

RECEIVER
This rear view of the assembly rack shows how the receiver parts are grouped conveniently together on the station's middle shelf

POWER SUPPLY
Here you can see the five electrolytic condensers, the power transformer, and the power tube, at right



"There's what gives it that corkscrew effect," Gus said, as he stood on one end of the front bumper and bounced the car as violently as he could



By MARTIN BUNN

GUS TELLS How to Adjust Shock Absorbers

"HEY, Gus! There's a lady outside wants to see you," Joe Clark called, as he came out of his little office at the Model Garage. Gus Wilson, his partner and the mechanic of the firm, was struggling with a refractory clutch.

"Take care of her yourself; you're the Don Juan of this outfit," the veteran automobile man grumbled, reaching for a wrench.

"All right, I will. It's old man Hackett's daughter," said Joe, with a twinkle in his eye.

"Hey! Wait a minute!" Gus snapped. "Why didn't you say it was Mary Hackett? That's one girl I don't mind talking to. She's got more sense about a car than most of the young fellows that come around here."

"How do you adjust shock absorbers, Gus?" asked Mary Hackett, as Gus appeared. "I've been trying all morning to get them right but the car seems to ride worse than ever. Now it has a sort of a corkscrew motion, like a boat that is taking the waves on the bias."

Gus walked all around the car, examining it critically, and then stood on one end of the rear bumper and bounced the car up and down as violently as he could. He repeated this operation at the other end of the rear bumper and at both ends of the front one.

"There's what gives it that corkscrew effect," he said, as he bounced one end of the front again. "The shock absorber on this side in the front and the one on the other side in the rear are a lot too loose, while the others are a bit too tight. And it looks to me as if the tires are unevenly pumped, too. Here you've got a hard tire and loose shock absorber and on the other side a soft tire and a stiff absorber."

"Why does that make it pitch and toss so on a rough road?"

"It's this way," Gus explained. "If you're going along a road with a lot of 'thank-you-marms,' or cross gullies, in it, the front wheels hit the depression first. They drop and the front of the car starts to drop after 'em, but the front wheels start to climb out of the hole before the car can drop much. On the side where the shock absorber is tight, the friction keeps the spring from pushing the car up so violently. On the other side, the car drops farther and gets kicked back harder. Naturally, the effect is to tip the body sideways. Now, when the rear wheels hit the same hollow in the road, the same thing happens, but in the other direction because the tight shock absorber is on the other side and the body gets a tip the other way."

"Now I see it," exclaimed Mary. "If the car happens to be going at the right

speed and the bumps are spaced right along the road, the car'll get to rocking back and forth."

"That's it exactly," Gus smiled. "You've got a mechanical head on your shoulders, Mary. Lots of men drive cars for years without the faintest notion of how shock absorbers work or what is sure to happen if they get out of whack."

"Tell that to Dad next time he comes in," laughed Mary. "He's keen on my knowing things about cars. Now show me how to adjust the shock absorbers so they'll be right."

"It's a pretty big job for a slip of a girl like you. You haven't enough heft to bounce a car up and down the way I did and that's about as good a way as any to tell what the shock absorber is doing."

He stepped to the front of the machine on the side where he had found the loose shock absorber. "Notice how when I bounce it up and down the action seems lively and springy. That's what you don't want. The shock absorber ought to be just tight enough to take the kick-back out of the spring and still not interfere with its up-and-down motion."

"See how it is now," he said, after he had reached under and tightened the adjustment. "No more bounce, but plenty of easy movement. Next thing is to get both front shock absorbers so they act just alike and (Continued on page 115)

THE HOME WORKSHOP



Official Magazine
POPULAR SCIENCE
MONTHLY

PRIZE WINNERS IN FIRST NATIONAL

Home Workshop Exhibition



Rufus C. Dawes presents the grand sweepstake prize to Earl G. Peek (at left) and Alexander Maxwell (center), president and secretary of the Chicago Premier Club

HIGH-SCORING CLUBS

Name and Address of Club	Points
Chicago Premier Homeworkshop Club, Chicago, Ill.	22
Rockford Homecraft Club, Rockford, Ill.	15
Eugene Craftsman Guild, Eugene, Ore.	13
San Diego Homecraft Club, San Diego, Calif.	12
La Grange Homeworkshop Club, La Grange, Ill.	11
Topeka Homeworkshop Club, Topeka, Kans.	11
Red Wing Homeworkshop Club, Red Wing, Minn.	11
Wood-Ridge Homeworkshop Club, Wood-Ridge, N. J.	11
Madison Homeworkshop Club, Madison, Wis.	9
Queen City Homecraft Club, Elmira, N. Y.	8
Creston Homeworkshop Club, Creston, Iowa	7
Greater Lawrence Homeworkshop Club, Lawrence, Mass.	6
Lincoln Homeworkshop Club, Lincoln, Nebr.	6
Saginaw Homecraft Club, Saginaw, Mich.	6
Capitol Homecraft Club, Washington, D. C.	5
Galesburg Homeworkshop Club, Galesburg, Ill.	5
North Shore Craftsman Club, Waukegan, Ill.	5
Spokane Homecrafters, Spokane, Wash.	5
The Dalles Homeworkshop Club, The Dalles, Ore.	5
Ashtabula Homeworkshop Club, Ashtabula, Ohio	4
Beckley Homecraft Club, Beckley, W. Va.	4
East Bay Homecrafters Club, Oakland, Calif.	4
Edison Homeworkshop Club, Chicago, Ill.	4
Fort Wayne Civic Homeworkshop Guild, Fort Wayne, Ind.	4
Newcastle Homeworkshop Club, Newcastle, Calif.	4
Norristown Homeworkshop Club, Norristown, Pa.	4
Seattle Homeworkshop Club, Seattle, Wash.	4

The Guild stages great show in Chicago . . . POPULAR SCIENCE MONTHLY readers display amazing craftsmanship . . . Their work hailed as vital new influence in American life

AMATEUR craftsmanship scored its greatest triumph at the first National Handicraft Exhibition and Contest of the National Homeworkshop Guild, held recently in Chicago. The show was one for which superlatives alone are adequate—the finest, most varied, and most completely representative display of its kind ever held. It won the Guild immediate recognition as a vital new national institution.

There were more than 1,000 individual items. The tables alone numbered 26, the majority of them richly veneered and inlaid, and one made of 70,000 pieces. Other furniture, including cabinets, chests, and one large flat-top desk, was richly carved. There were more than 50 examples of veneered and inlaid work, on several of which 700 hours of work each had been lavished. The wood turnings were in excess

of 150. There were 63 models of ships, locomotives, buildings, villages, airplanes, and industrial equipment. One decorative model alone contained more than 4,000 pieces, and some of the models were of the working variety, incredibly accurate and intricate. Even of such projects as lamps and clocks, there were nearly 60.

The originality and ingenuity of Guild members were particularly well demonstrated in the novelty and toy division. The first prize-winning exhibit in this section was a lion within a cage, both carved from a single large block of walnut. Since the lion had to be shaped by working between the bars of the cage, the skill and patience required are obvious. Another novelty was a replica of a common pin, turned actual size from wood on an 11-in. lathe. There were also many projects of unusual materials, such as alabaster, in this division.

The publicity and public interest were on a commensurate scale. In a scrapbook containing only some of the newspaper stories from the larger papers, there are 55 clippings and 16 pictures. Numerous radio announcements were made, including

one that went out on a national hook-up.

Delegates came from many clubs outside the Chicago area. The first visitors to sign the register, for example, were Mr. and Mrs. O. E. Harvey of the Beckley Homecraft Club, Beckley, W. Va.

The number and extraordinary quality of the exhibits not only amazed the thousands of visitors, but gave the eight judges such a problem that hours were spent by them in earnest inspection and debate. The judges took their work so seriously that even under the able and vigorous chairmanship of Rufus C. Dawes, it was all they could do to vote upon the merit of the hundreds of exhibits in the course of a whole afternoon.

The Chicago Premier Homeworkshop Club won the grand sweepstake prize—a silver cup and \$200 in cash—with a score of 22. Members of that club carried off one first and one second prize and two third prizes, and gained a substantial extra allowance by having entries in seven contest divisions. The Rockford Homecraft Club was second with a score of 15, and the Eugene Craftsman Guild of Eugene, Ore., third with 13 points. The score of the leading clubs is given on the preceding page.

A complete list of the principal awards, classified by contest divisions, appears in the accompanying tabulation. There was so much excellent work, however, that a number of additional prizes were granted. These are listed separately on page 95. Under the rules, these extra awards could not be counted in the score of the various clubs for the sweepstake prize, but they indicate that the work of many individual craftsmen was of exceptionally high quality and deserved special recognition. The extra prizes were silver medals bearing the Guild emblem, donated by POPULAR SCIENCE MONTHLY. It should be noted that the various trophies became the permanent property of the winners and will not be placed in competition again.

The announcement of awards was made at the first annual dinner of the Guild, held at the Hotel Sherman, Chicago. LeVern T. Ryder, president of the Guild, presided, and the speakers included Mr. Dawes, Tony Wons, the radio philosopher, and Howard Vincent O'Brien, famous columnist, all three of whom were members of the board

Thomas E. Tallmadge, noted architect, with table that won first prize for furniture made with power tools. It is solid walnut inlaid with holly



This table, of flawless construction, won first prize for hand-made furniture

Lorado Taft, famous sculptor, examines three wood carvings. The figure on the right won first prize; that at left, second; and the bear, third



AWARDS MADE IN TEN MAIN

DIVISION 1—CLUB WOODWORKING

Sponsored by Stanley Tools, Hand and Electric Tools, New Britain, Conn.

FIRST PRIZE, \$100 and silver cup—Rockford Homecraft Club, Rockford, Ill.

SECOND PRIZE, \$65—La Grange Homeworkshop Club, La Grange, Ill.

THIRD PRIZE, \$35—Wood-Ridge Homeworkshop Club, Wood-Ridge, N. J.

DIVISION 2—CIVIC ACTIVITIES OF CLUBS

Sponsored by Millers Falls Company, Greenfield, Mass.

FIRST PRIZE, \$100 and silver cup—Topeka Homeworkshop Club, Topeka, Kans.

SECOND PRIZE, \$65—Creston Homeworkshop Club, Creston, Iowa.

THIRD PRIZE, \$35—Wood-Ridge Homeworkshop Club, Wood-Ridge, N. J.

HONORABLE MENTION—Queen City Homecraft Club, Elmira, N. Y.

DIVISION 3

FURNITURE MADE WITH HAND TOOLS

Sponsored by E. C. Atkins and Company, Indianapolis, Ind.

FIRST PRIZE, \$100 and trophy—H. C. Keysor, La Grange (Ill.) Homeworkshop Club, for walnut table.

SECOND PRIZE, \$65—A. O. Stenwick, Red Wing (Minn.) Homeworkshop Club, for carved pioneer cabinet.

THIRD PRIZE, \$35—Merle J. Eddy, Ashtabula (Ohio) Homeworkshop Club, for carved flat-top desk.

DIVISION 4

FURNITURE MADE WITH POWER-DRIVEN TOOLS

Sponsored by the Delta Manufacturing Co., Milwaukee, Wisc.

FIRST PRIZE, \$100 and silver cup—Robert Zeiner, the Greater Lawrence Homeworkshop Club, Lawrence, Mass., for a walnut table inlaid with white holly.

SECOND PRIZE, \$65—Theodore T. Clemesha, San Diego (Calif.) Homecraft Club, for a reproduction of a thirteenth century vestment chest made from old wood.

THIRD PRIZE, \$35—Ernest H. Rye, Chicago Premier Homeworkshop Club, for an end table with six legs.

DIVISION 5—VENEERING AND INLAYING

Sponsored by the Casein Manufacturing Company of America, Inc., New York, N. Y.

FIRST PRIZE, \$100 and silver cup—Theodore T. Clemesha, San Diego (Calif.) Homecraft Club, for a jewel box of crotch and butt walnut with bird's-eye maple corners.

SECOND PRIZE, \$65—George A. Simonds, of the Capitol Homecraft Club, Washington, D. C., for a pair of inlaid walnut and cherry book ends.

THIRD PRIZE, \$35—W. E. Mitchell, Spokane (Wash.) Homecrafters, for an inlay picture "Lombardies and Brook."



One small section of the display of decorative metal work. This gives a general idea of the arrangement of the exhibition. There were many similar but much larger display tables, dividing the exhibition into a series of aisles

DIVISIONS OF GUILD CONTEST

DIVISION 6—WOOD TURNING

Sponsored by Greenlee Tool Co., Division of Greenlee Bros. & Co., Rockford, Ill.

FIRST PRIZE, \$100 and silver cup—Harold M. Davenport, Eugene (Ore.) Craftsman Guild, for turned fruit bowl of myrtle wood.

SECOND PRIZE, \$65—Robert B. Dyer, Lincoln (Nebr.) Homeworkshop Club, for a turned and inlaid buffet set.

THIRD PRIZE, \$35—Martin F. Johnson, Eugene (Ore.) Craftsman Guild, for a turned and carved mahogany lamp.

DIVISION 7—NOVELTIES AND TOYS

Sponsored by Henry Disston & Sons, Inc., Philadelphia, Pa.

FIRST PRIZE, \$100 and silver cup—A. O. Stenwick, Red Wing (Minn.) Homeworkshop Club, for a lion within a cage, both being carved from a single solid block of walnut.

SECOND PRIZE, \$65—Fred Spinden, Abingdon, Ill., member of the Galesburg Homeworkshop Club, for a farm wagon, tea kettle, coffee pot, and skillet made entirely of safety matches.

THIRD PRIZE, \$35—P. F. Hirsch, Newcastle (Calif.) Homeworkshop Club, for a toy donkey and cart.

DIVISION 8—MODEL MAKING

Sponsored by Russia Cement Company, Gloucester, Mass.

FIRST PRIZE, \$100 and silver cup—Emil Kurtz of Villa Park, Ill., member of the Chicago Premier Homeworkshop Club, for a model yawl.

SECOND PRIZE, \$65—Edwin J. Davis, Rockford (Ill.) Homecraft Club, for a working model J. I. Case steam threshing engine, coal fired.

THIRD PRIZE, \$35—F. L. Stoutimore, Chicago Premier Homeworkshop Club, for a miniature Early American interior.

DIVISION 9—DECORATIVE METAL WORK

Sponsored by the Carborundum Company, Niagara Falls, N. Y.

FIRST PRIZE, \$100 and special trophy—L. J. Pickarts, Madison (Wisc.) Homeworkshop Club, for a pewter bowl with handles.

SECOND PRIZE, \$65—W. Sovich, Chicago Premier Homeworkshop Club, for a metal jewel casket.

THIRD PRIZE, \$35—C. T. Phillips, Oakland, Calif., member of the East Bay Homecrafters Club, for a miniature treasure chest.

DIVISION 10—GRAND SWEEPSTAKE PRIZE

Sponsored by Popular Science Monthly, New York, N. Y.

Silver cup and \$200—Chicago Premier Homeworkshop Club, which scored twenty-two points.



This pewter bowl with handles, a marvelous piece of metal craft, was awarded first prize in the decorative metal-work division

of judges; Francis D. Bowman, known throughout the country for his direction of the Carborundum broadcasts, and Arthur Wakeling, home workshop editor of *POPULAR SCIENCE MONTHLY*. In addition to the three men previously mentioned, the judges were Lorado Taft, sculptor; Thomas E. Tallmadge, architect; Edward F. Worst and L. W. Walstrom, supervisors of industrial arts; and Donald A. Price, amateur craftsman and designer. The judges were the guests of honor at the dinner. E. Raymond DeLong, secretary of the Guild, other national officers, and many guests were present.

The speakers were unanimous in saying that the exhibition marked a new era in the home-workshop movement. Tony Wons, in a characteristic talk, revealed that his special interest is in making violins.

"When Mr. Bowman remarked a few minutes ago that I get my fun fiddling with fiddles," he said, "he was expressing it very mildly. Making things has always appealed to me, but I have had to travel around a good deal and it has been difficult to take home-workshop equipment with me. One day the idea struck me that violin making would not require many tools and would be lots of fun. That same afternoon I purchased a complete set of the necessary tools and materials and went to work. Now, before I go to the studio every day, I spend what time I can in my little shop at home, up in the attic. There I lose myself in the joy of creation—of building something with my hands—of making something that will talk to me after I've

(Continued on page 94)

The beveled chines of the racing runabout allow perfect turns, even at high speed, and have no tendency to catch or dig into the water



SPEED AND COMFORT COMBINED IN OUR NEW

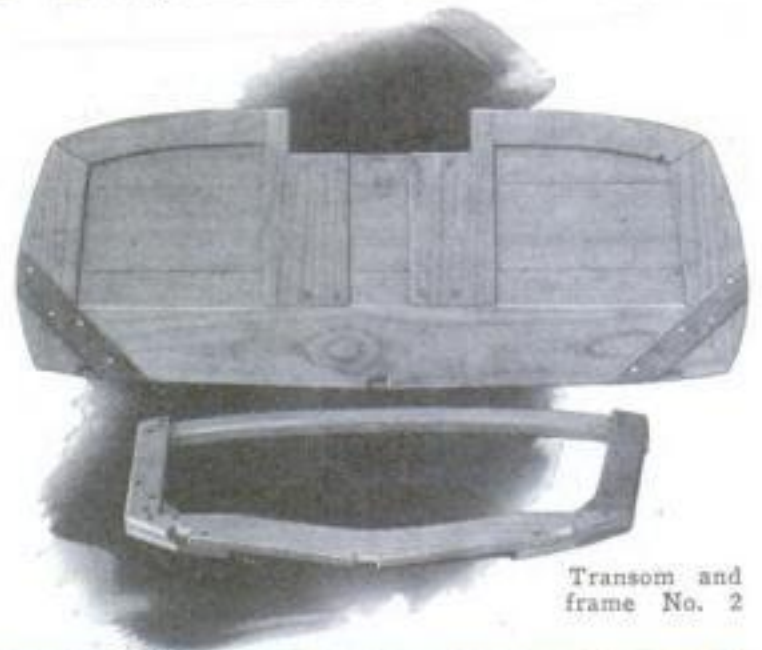
Racing Runabout

THIS new 13-ft. racing runabout answers the demand for a boat that can be raced successfully, yet has features of size, stability, riding comfort, and seaworthiness that make it ideal for general pleasure use. It meets all requirements of the runabout racing class, the rules of which prevent the entry of out-and-out racing boats.

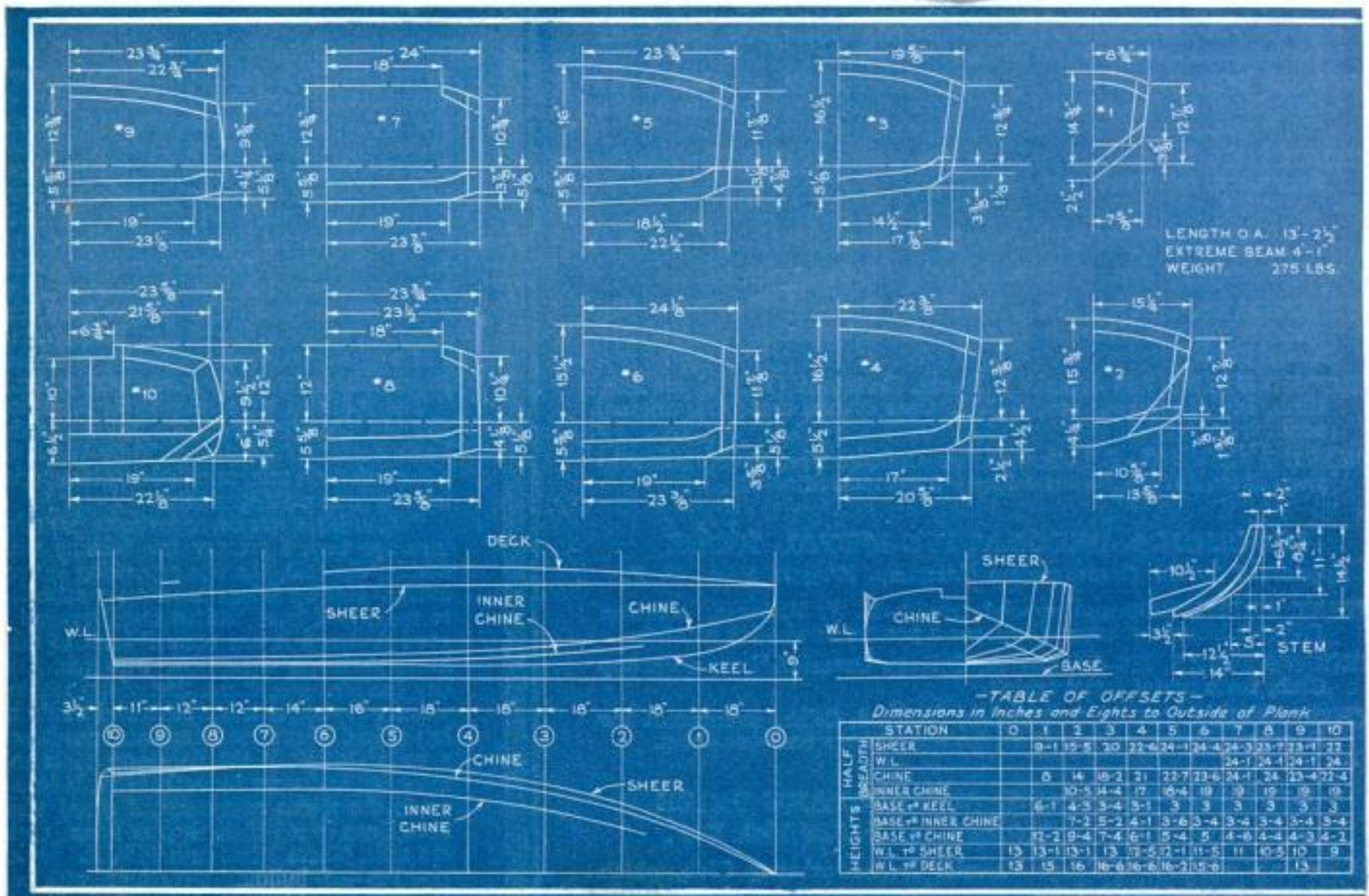
The building of racing runabouts was pioneered several years ago on the Pacific Coast, and the new boat is the result of much experience in designing, racing, and manufacturing them. Several previous designs have set world's records for runabout classes. The final result of count-

less refinements and changes, this new racing runabout will hold its own in the stiffest competition to be found anywhere in the country, yet it will carry a load well and ride smoothly. Beveled chines make the craft nontripping, regardless of how sharp a curve is attempted. Simplicity of construction has been stressed; for instance, no rabbeting is necessary except in the stem.

The over-all length of the craft, measured according to the racing rules, is just over 13 ft., which is the minimum length. The water-



Transom and frame No. 2



The lines of the racing runabout with a table of offsets giving the dimensions at the eleven station points, and detail drawings of frames and stem



No more striking proof of the efficiency of this boat can be given than the fact that it planes perfectly when only a nine-horsepower outboard motor is used. It is eligible for all runabout racing classes

A fast stepless hydroplane built to meet the National Outboard Racing Commission rules

by

WILLARD CRANDALL

from a design by

BRUCE N. CRANDALL

line beam is 4 ft. $\frac{1}{4}$ in., or $\frac{1}{4}$ in. greater than the minimum beam allowed. It is eligible for all runabout racing classes—service motor classes C and E, and racing motor classes C and F.

The National Outboard Racing Commission has specified various other restrictions in order to make sure strictly racing boats cannot compete. Some of these restrictions are: minimum hull weight for classes E and F, 275 lb., and for class C, 200 lb.; minimum total racing weight (crew, motor, boat, etc.) 775 lb. for

NOTE: A complete copy of the runabout racing rules can be obtained from the National Outboard Association, 201 N. Wells St., Chicago, Ill.

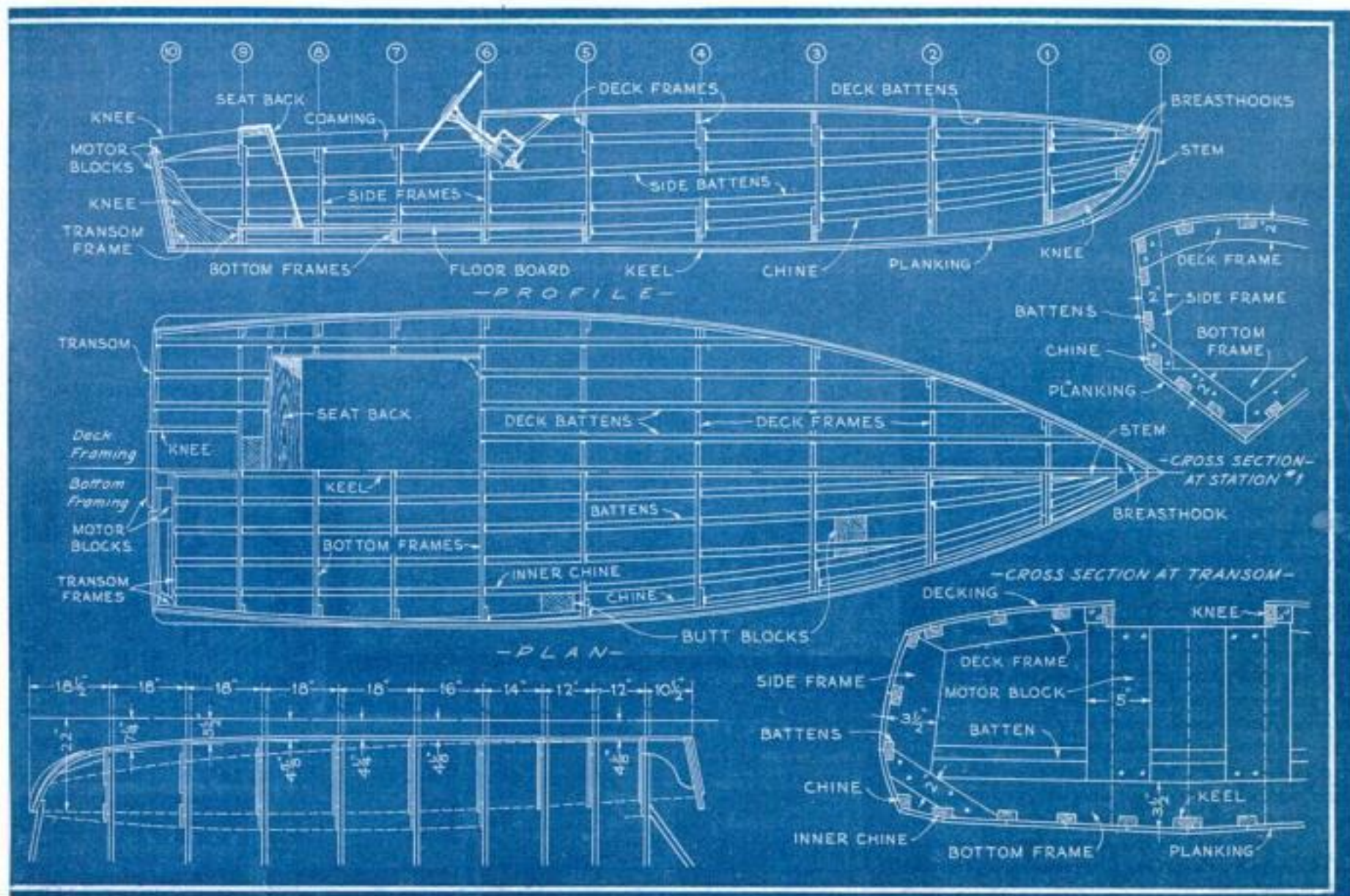
classes E and F, and 550 lb. for class C; no step in the bottom of the hull; minimum freeboard 15 in.

The ideal materials to use are: Philippine mahogany for planking (other types of mahogany are usually much more expensive), and airplane spruce for the entire framework. The total cost, including all hardware and fittings, should not be over \$50, but it will vary a great deal in different parts of the country. If mahogany or spruce cannot be obtained locally, the best second choice would be cedar for planking, battens, and chines, and oak for frames and keel. In the list of materials on a following page the other materials are listed in order of their suitability.

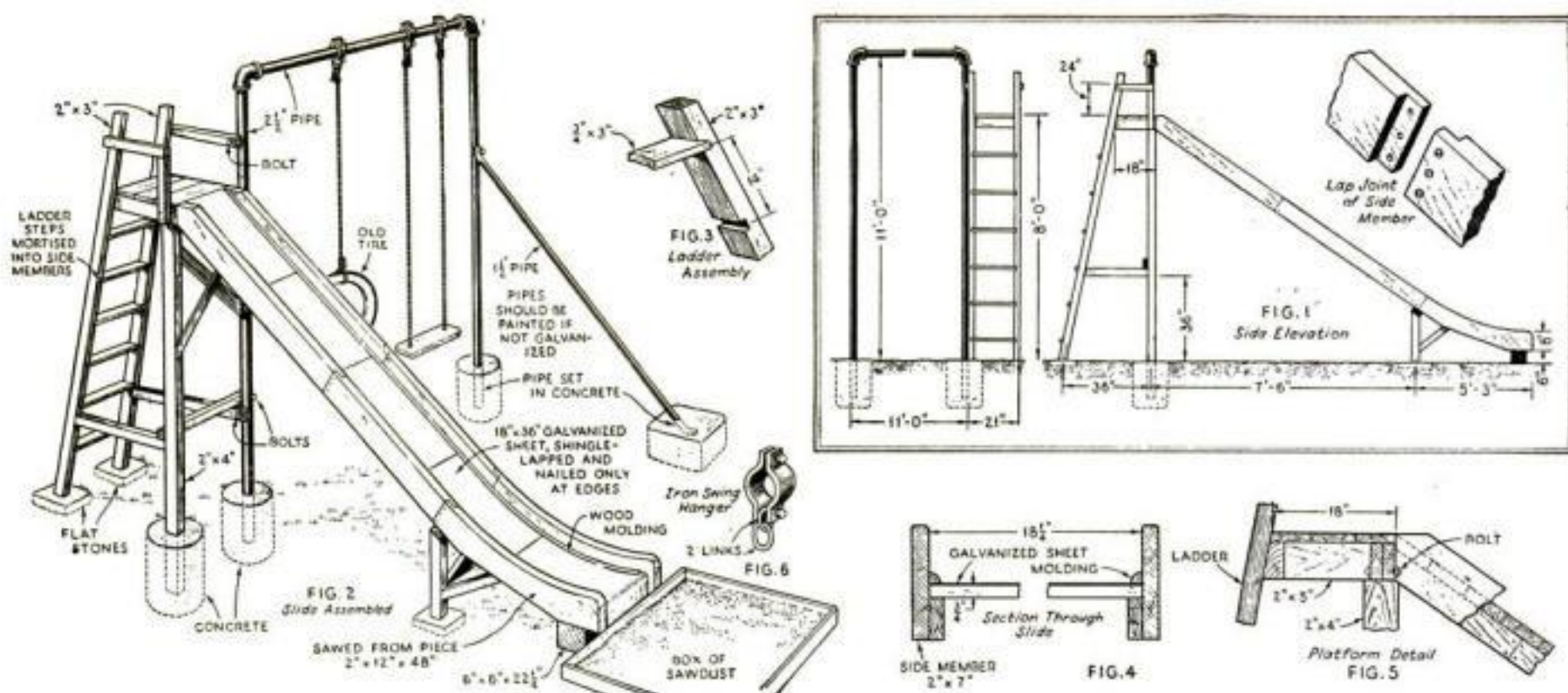
All screws and bolts should be flathead brass unless otherwise specified, but if the boat is to be used only in fresh water, galvanized iron can be substituted to reduce the cost.

If mahogany planking and spruce framework are used, the boat will weigh very close to 275 lb., including all fittings. All of the alternate materials listed for the framework are heavier than spruce, but some of the other materials specified for planking, such as cedar and spruce, are lighter than mahogany. As the racing rules call for a boat weighing 275 lb. for classes E and F and only 200 lb. for class C, a set of specifications are given at the end of the list of materials for the light class-C boat.

The first thing to do is to draw a complete set of full- (*Continued on page 76*)



Two views of assembled framework, a cross section at station No. 1 and another at the transom, and a diagram to aid in setting up the frames



Back-Yard Playground Built at Low Cost



This homemade playground keeps the children off the street

SCRAP materials picked up at a minimum cost were used to a large extent in building the compact playground equipment illustrated at the left and shown in detail above. The principal exceptions were the galvanized sheets and side members of the slide, for which new materials were bought.

As can be seen by the dimensions given in Fig. 1, the equipment requires comparatively little space and can be erected in any spare corner of the back yard. The perspective drawing, Fig. 2, shows how to go about building it. Note that the uprights and iron pipe are set in concrete, but this is not absolutely necessary. If the wood below ground is creosoted, it will last almost indefinitely. The pipe, if not galvanized,

should be protected with paint.

First build the ladder by the method shown in Fig. 3, and assemble with the pipe and 2-by-4-in. upright supporting the platform. Note that the ladder steps are mortised into the side members. This is not absolutely necessary, but makes a better job. The slide can be built upon the ground and erected later. The construction is given in Fig. 4. The side members are lap-jointed as shown in a perspective sketch. Molding is nailed over the edges of the galvanized sheets, which are laid overlapping, shingle fashion. The lap should not be nailed.

When completed, the side is joined to the platform as shown in Fig. 5, with bolts through the cross members at the joint.—H. S.

HINTS ON LAYING OUT A WELL-EQUIPPED HOME WORKSHOP

MANY layouts for small and medium size home workshops have been published in previous issues, but here is a carefully studied plan for a large basement shop. It is the personal workshop of R. C. Wieboldt, Evanston, Ill., president of one of the largest general contracting firms in the Middle West.

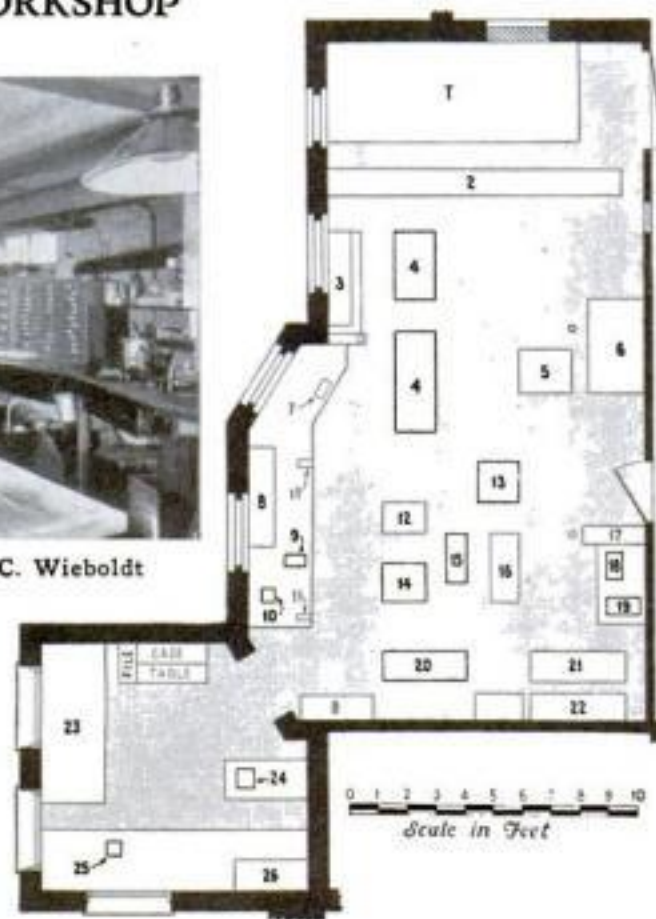
The machines and equipment in a shop of this kind have to be arranged to suit the available space, but no matter what that is, a convenient grouping can be obtained by careful planning. Note particularly the central position of the circular saw in Mr. Wieboldt's shop, the position of the band saw adjacent to the short lumber rack, the position of the lathes, and the grouping of the drill press, bench grinder, machinist's vise, gas furnace, and other metal working equipment at the long metal-working bench. Care has been taken to place the drawing table in a good light and as far away as possible from the main part of the shop. Adjacent to that table is a large layout table with a precision drill and other equipment for finishing.



A part of the large home workshop of R. C. Wieboldt

KEY TO PLAN

- | | |
|-----------------------|--------------------|
| 1 Lumber rack | 14 Grinder |
| 2 Metal drawer case | 15 Joints |
| 3 Screw and bolt case | 16 Table |
| 4 Bench | 17 Locker |
| 5 Band saw | 18 Buffer |
| 6 Short lumber rack | 19 Jig saw |
| 7 Grinder | 20 Metal lathe |
| 8 Tool case | 21 Wood lathe |
| 9 Drill press | 22 Tool shelf |
| 10 Gas furnace | 23 Drafting table |
| 11 Vise | 24 Router |
| 12 Wood trimmer | 25 Precision drill |
| 13 Circular saw | 26 Parts case |



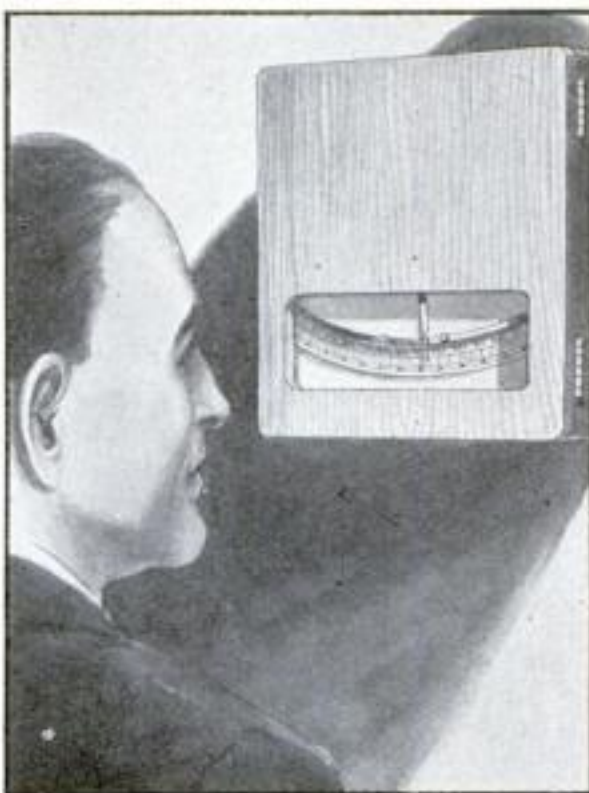
ACCURATE
Maximum *and* Minimum
THERMOMETER

By Edwin M. Love

AT THIS time of the year warm days are to be expected. Before long you will be exclaiming that this is the hottest June in several years—or contrarily, the coolest. No half-way measures about the weather! You will therefore want to add to your observation equipment a maximum and minimum thermometer, which will indicate, in addition to the temperature at the time you look at it, the highest and lowest points reached since the last previous reading.

The thermometer described in this article can be built from odds and ends to be found around home or in an automobile wrecking yard; and being bimetallic, will register temperatures too high for an alcohol thermometer and too low for the mercury type.

For the sensitive element, obtain a flangeless cover from an automobile horn motor, one about 3½ in. in diameter that is drawn from steel less than 1/16 in. thick. Remove all grease and paint, and tin the outside with solder. Around the outside, solder enough brass strips of about the



Two small U-shaped indicators on a track record the highest and lowest temperatures



The sensitive element is made of steel and brass and is like a split cylinder in shape

same thickness to cover it for a width of 2 in. If they are cut $\frac{1}{2}$ in. longer than the circumference, and the ends are bent back, they can be clamped together with pliers until held with solder. With all ends fast, sweat the strips on, taking care that the metal flows through the joints at all points.

Soldering done, saw off the closed end of the cover, and cut the side open, leaving a gap about $\frac{3}{4}$ in. wide. After drilling the holes, clean up with a file.

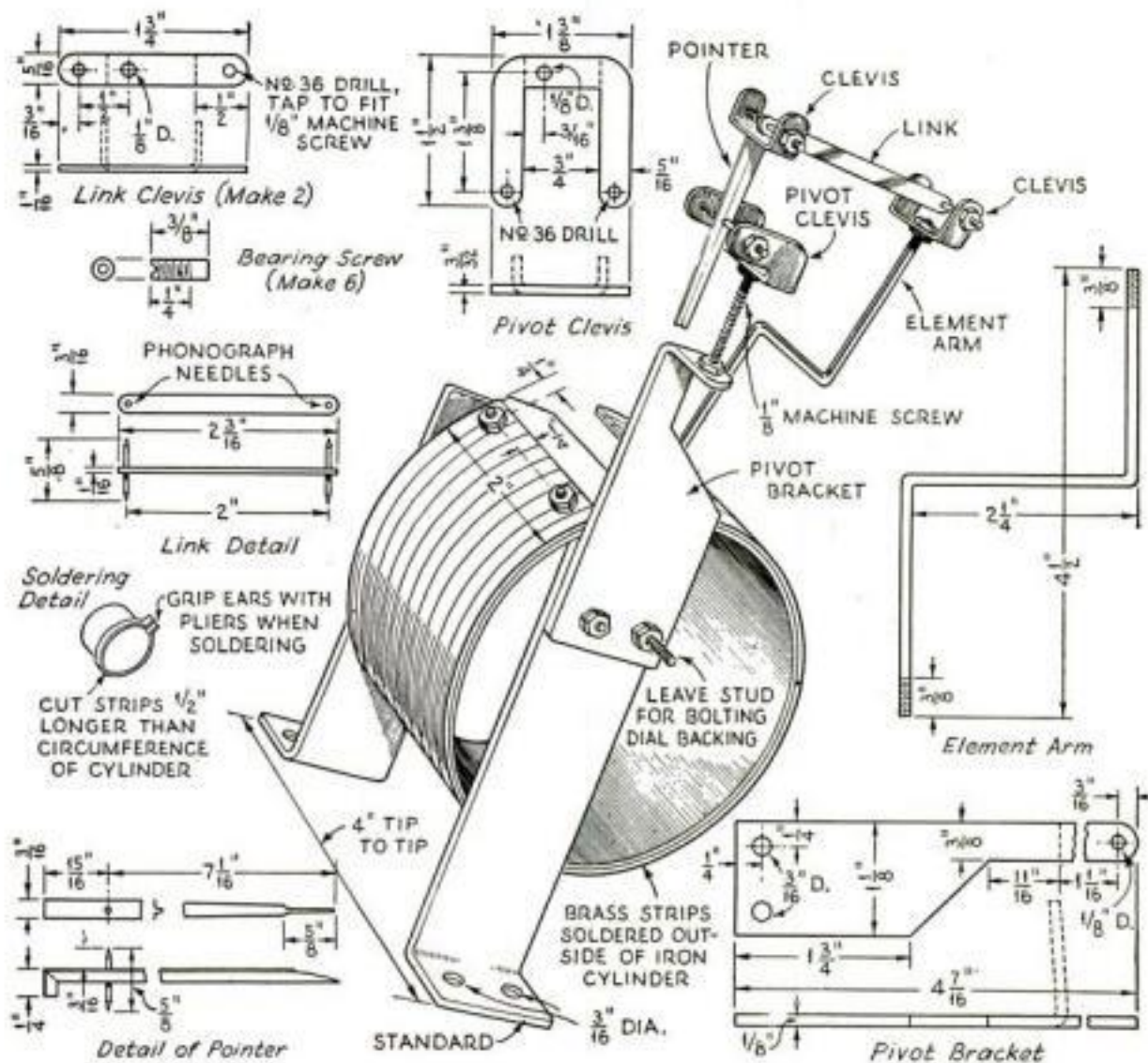
There is nothing difficult about the iron framework, which is fully explained in the drawings. You can use aluminum if you wish, which will work easier. Take some care with the bent-down flap to which the element is bolted, adjusting the slope to center the element properly. Most of the holes should be drilled somewhat larger than screw size, so that some adjustment of position can be easily made. You will note that the photographs show the screw pivot post bent into an S, while the drawings detail it as straight. The bending in the original thermometer was due to experimental changes of design, and dimensions are such in the plans that bends are unnecessary, clearances being ample.

While any stiff wire may be used for the element arm, drill rod is better, as it can be hardened to reduce springiness.

In making the clevises, notice the mounting holes, so that pointer clearance will be maintained. Brass or steel serve very well as materials, although aluminum is to be preferred because it lightens the movement.

The pivots and bearings are like those of the balance wheel of an alarm clock—cone points working in cone-shaped cups. Both parts should be tempered hard, drill rod or the shanks of broken drills being used for material. If you have no lathe or drill press in which to turn the bearing cups, make dimples with a sharp prick punch. Thread the bearings before cutting them to length.

Phonograph needles form excellent pivots, as the temper can be drawn and the butts filed to (Continued on page 90)



Sketch showing the general arrangement, but with the lower part of the pointer omitted for clearness; and details of the offset element arm, link, clevises, pointer, and other parts



When a torpedo from the submarine hits the right spot, a mousetrap hidden in the battleship makes it explode

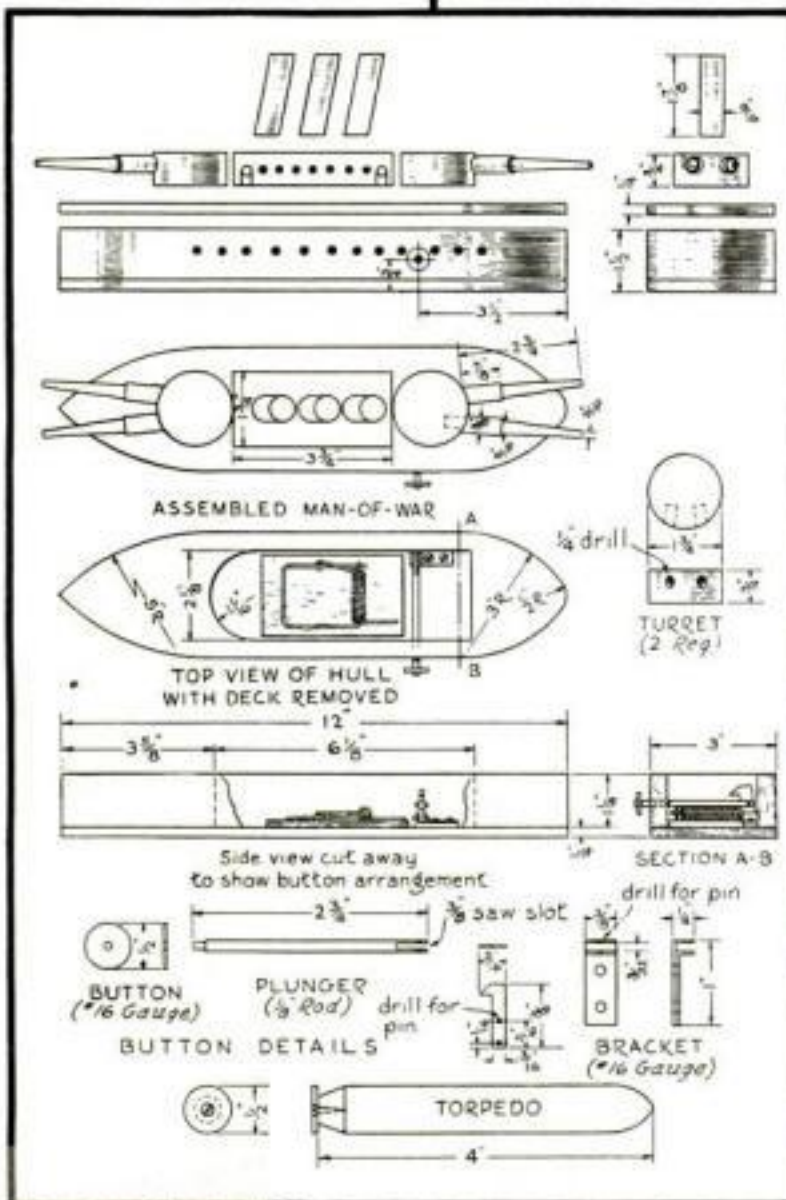
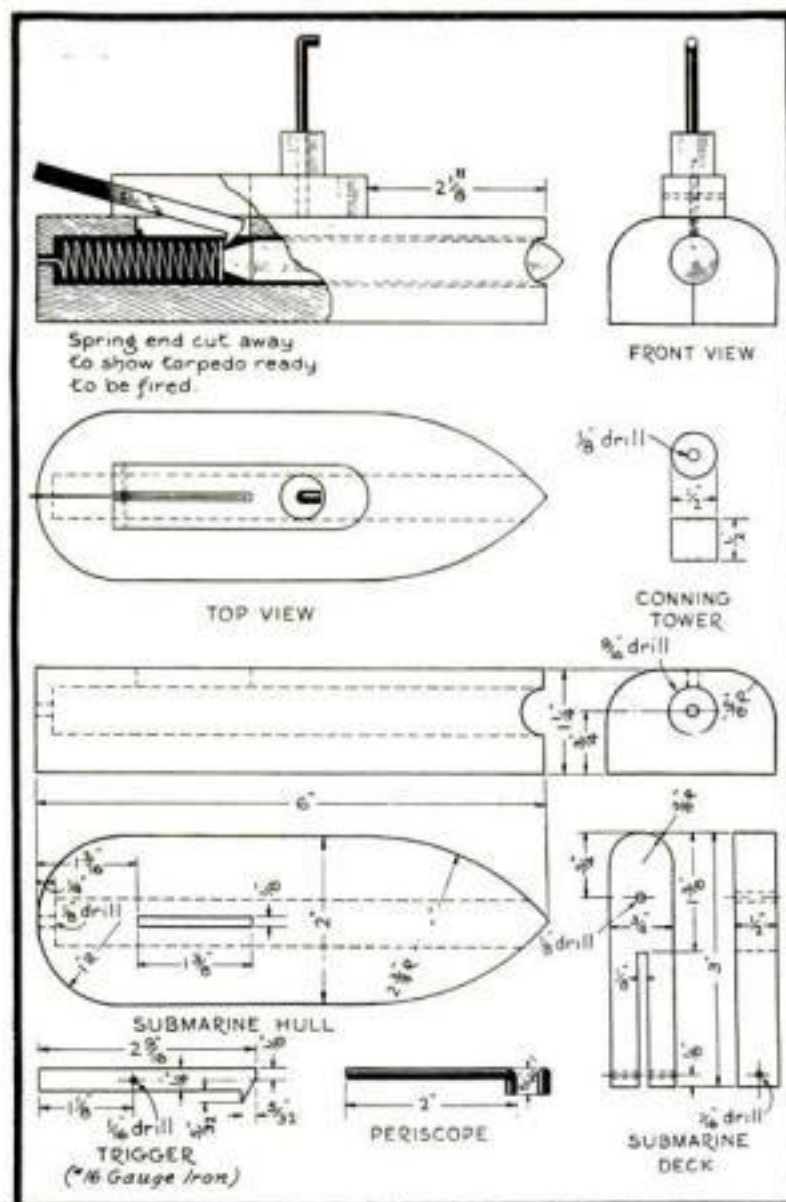
Toy Man-of-War Blows Up WHEN HIT BY TORPEDO

DECK, superstructure, gun turrets, and stacks are blown from the toy wooden man-of-war illustrated when it is struck in a vital spot by a torpedo shot from the submarine. The source of this spectacular explosion is hidden within the battleship and is nothing more than a mousetrap.

No damage is really done to the ship. It is made ready for action again merely by setting the trap, laying the deck on the hull, standing the deck house and turrets on the deck, and putting the stacks in place.

The hull of the battleship is cut from 1 1/4-in. white pine. The submarine can be made from the 2 1/8 by 6 1/8 in. piece that is cut out of the larger hull. Drill a hole in the ship's side to allow the 1/8-in. plunger to pass freely through. I inserted a shoe eyelet here to serve as a bearing. Cut two pieces of 1/4-in. plywood, one to be glued and nailed to the bottom of the hull, the other to be used as a deck. The deck house is a block 3/4 by 1 1/4 by 3 3/4 in. The three stacks are pieces of 9/16-in. dowel, 1 7/8 in. long. The turrets are 3/4 by 1 3/4 in. in diameter, with two 1/4-in. holes drilled on a slight angle to receive the guns, which are turned from 3/8-in. dowels.

The button is a 1/2-in. disk cut from 16-gauge iron, with a 3/32-in. hole to receive the end of the plunger. The button and plunger are riveted together, and a



Assembled submarine with spring and torpedo in place, and details of all the parts

slot is cut in the end of the plunger for the finger, which is cut to the shape shown. The bracket is also cut from 16-gauge iron, bent to shape, and drilled so that it can be fastened to the bottom of the boat with small wood screws.

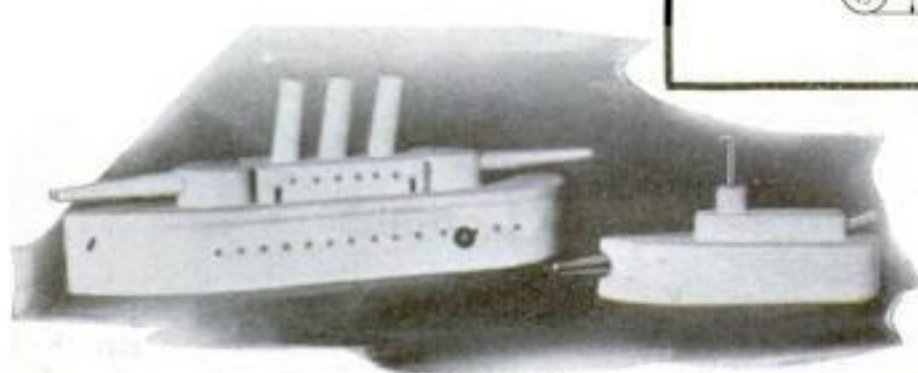
After the bracket is put in place, the finger is pinned to it. The plunger is then passed through the hole in the side of the boat and pinned to the finger. These two joints must work freely to release the trap when the button is struck by the torpedo.

The trap is taken off the baseboard and moved back about 1/4 in., and the bait hook is left off altogether. A piece of the baseboard must be sawed off in order to allow the trap to be nailed in the boat so the finger will hold the loop back. When the trap is nailed in place, the boat is complete.

After shaping the submarine, drill a 9/16-in. hole 1/4 in. from the bottom, passing through all but 1/4 in. Cut the slot in the top of the hull as shown, and in the center of the 9/16-in. hole drill a 1/8-in. hole the rest of the way
(Continued on page 97)

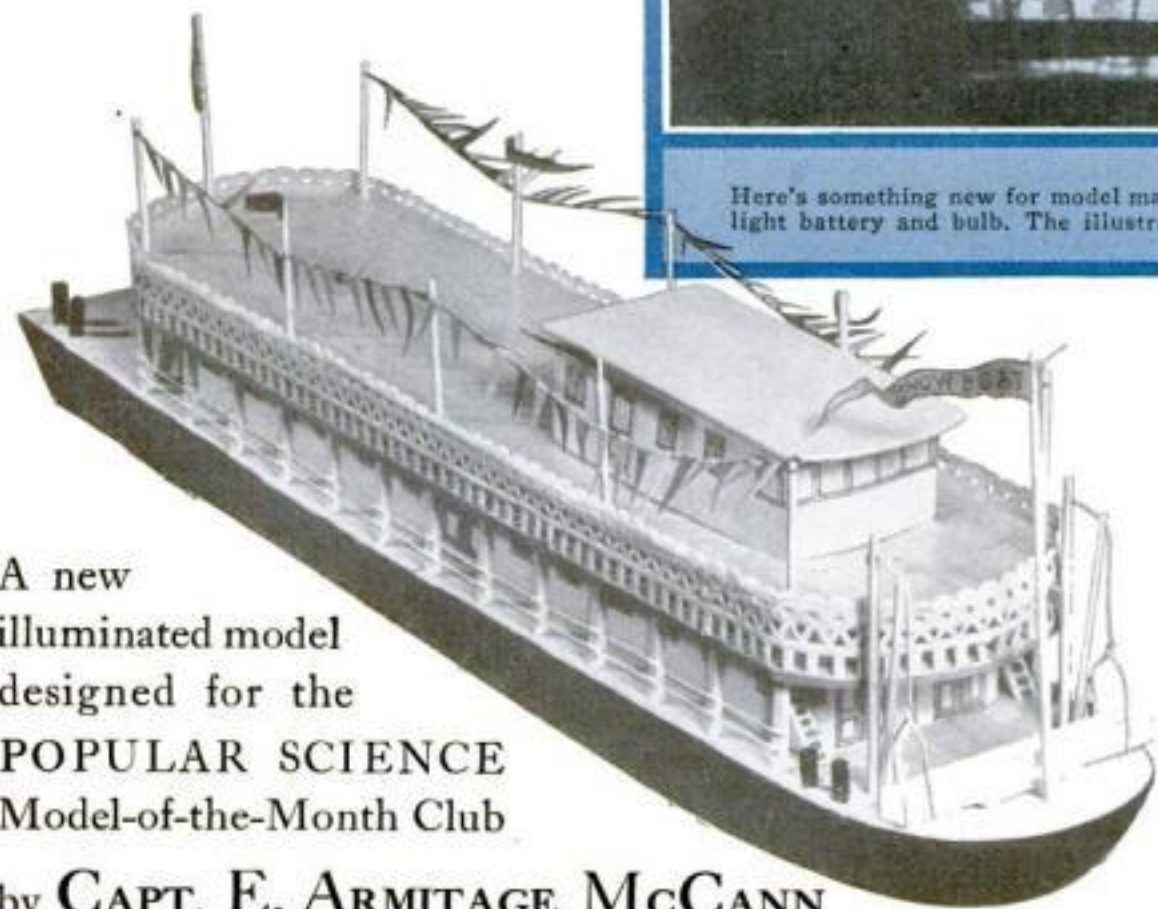
How the battleship is constructed, the mousetrap mechanism, the torpedo, and, at left, the complete warship and "sub"

By
Carl G. Senf



Miniature SHOW BOAT

*Gleams with
Colored Lights*



A new
illuminated model
designed for the
POPULAR SCIENCE
Model-of-the-Month Club

by CAPT. E. ARMITAGE McCANN



Here's something new for model makers—a miniature show boat illuminated by a flash-light battery and bulb. The illustration above is from an actual photo of the model

A SHOW boat by night, lights agleam, flags flying, gay in paint and bunting—that was one of the most picturesque sights along the Mississippi River in the old days. There will never be anything like it again, but you can easily reconstruct the scene in miniature by making our new illuminated show-boat model.

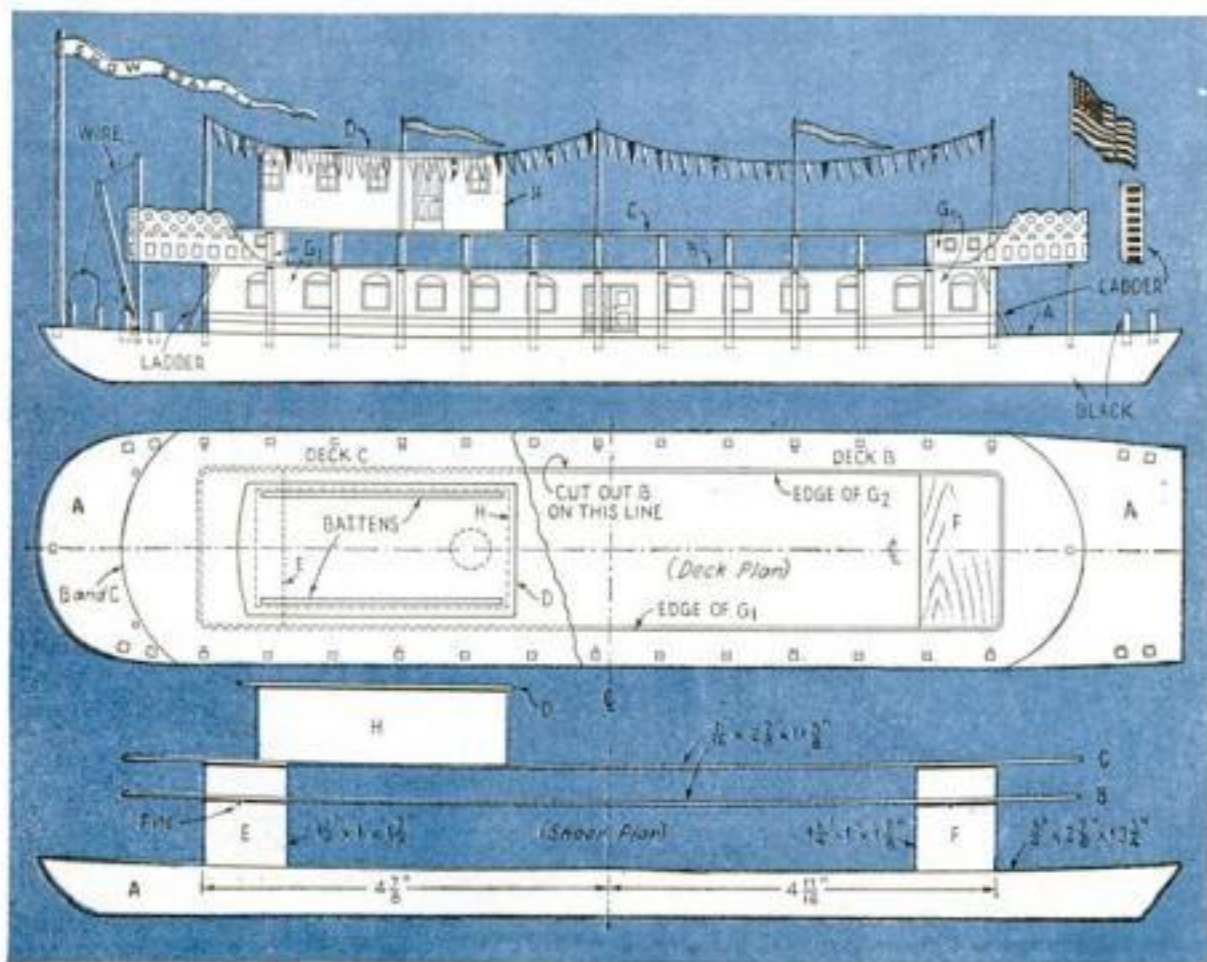
Built on a scale of approximately 1/12 in. to 1 ft., the model is almost 14 in. long. It represents a typical Mississippi River traveling theatre of the 1870's and 1880's. They were from 100 to 200 ft. long and were towed from place to place by a steamboat. Since they were very colorfully decorated as a rule, you can go as far as you like in painting the model.

Hull. Sandpaper block *A* (see list of materials at end of article for over-all dimensions and the drawings for finished dimensions) until 3/4 in. thick and 2 7/8 in. wide. Sandpaper the top surface on a slight curve from end to end so that the middle is a full 1/8 in. less in thickness than the ends. Shape the stern and bow as shown. Round bottom corners a trifle. Varnish top; paint remainder black.

Superstructure. Make *B* and *C* together and exactly the same width as *A*. Lay both on hull. Drill 3/32-in. holes through both and about 1/4 in. into hull at positions indicated on deck plan to receive posts (which, however, will be square). Also drill 1/16-in. holes for after flagstaff and similar holes for the others through decks *B* and *C* only. All decks are natural wood, varnished, although they could be painted buff, if preferred.

Make blocks *E* and *F* and round their outside vertical corners. Glue them to hull exactly where shown on deck and sheer plans.

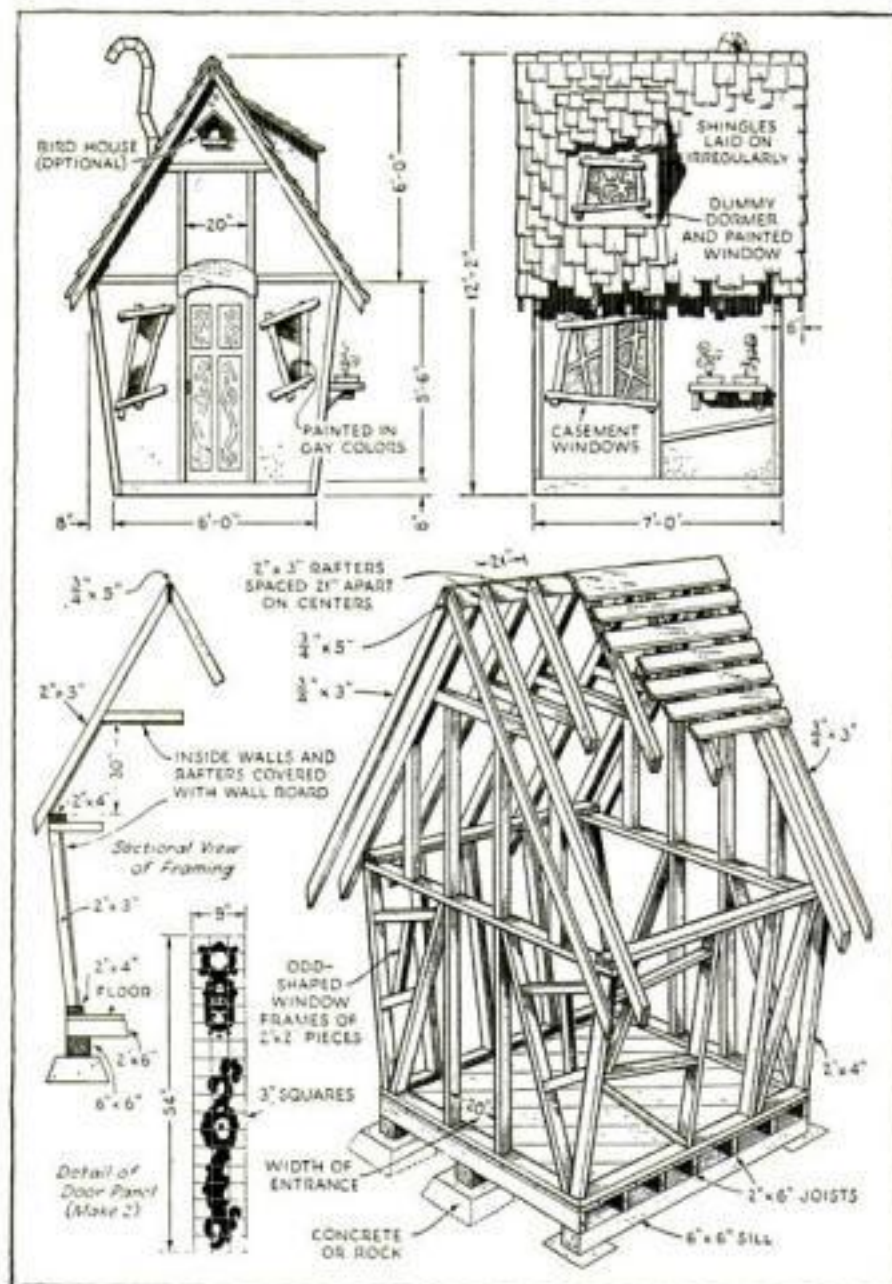
Cut cardboard pieces *G*¹ and *G*². With 1/4-in. chisel or razor blade, cut the 10 blank windows in each; also top panels of center doors, if you wish. Glue front edge of *G*¹ to center of block *E*; stretch it along deck, and (Continued on page 82)



Working drawings. The top of deck *B* is 7/8 in. above *A*, and the top of *C*, 1 5/16 in. above *A*

A Fairy-Tale Cottage

TO ORNAMENT YOUR GARDEN



Used either as a child's playhouse or as a tool house, this building adds a quaint touch to any garden. The construction is shown at left

ORIGINALITY and imagination are embodied in this little fairy-tale cottage, which can be constructed in any garden at relatively small cost. Besides serving as an ornament, it may be put to practical use either as a playhouse for children or as a tool house.

The original building was erected in Laguna Beach, Calif., where it was found sufficient to cover the framework with wall board. The seams were concealed with battens and the whole protected against moisture with several coats of paint. Boards, wood siding, or shingles would, of course, be more substantial.

Wall board is fastened on the inside of the walls and over the rafters. There should be a vent in the ceiling and in one gable. The space under the peak of the roof may be used for a bird house, if desired, with an entrance in the front gable.

A bright color scheme such as red, black, and bronze, or light and dark green with orange trimmings is most effective. Plant shrubs of the more unusual varieties around the house and, if possible, lay a winding flagstone walk.—H. SIBLEY.

Small Rustic Pool Conceals Ugly Back-Porch Foundation

TO HIDE the unsightly back-porch foundation that is an eyesore in so many yards, a rustic pool and foundation can easily be constructed as illustrated below.

For the dimensions given, about 1 cu. yd. of a 1-2-4 mixture is required. This would be approximately 6 sacks of cement, $\frac{1}{2}$ ton of sand, and $1\frac{1}{2}$ tons of gravel. The form is made of sheet iron. If you do not care to use concrete, a satisfactory method is to line the inside of

the excavation with stones from 4 to 6 in. in diameter, set in cement mortar and well pointed up.

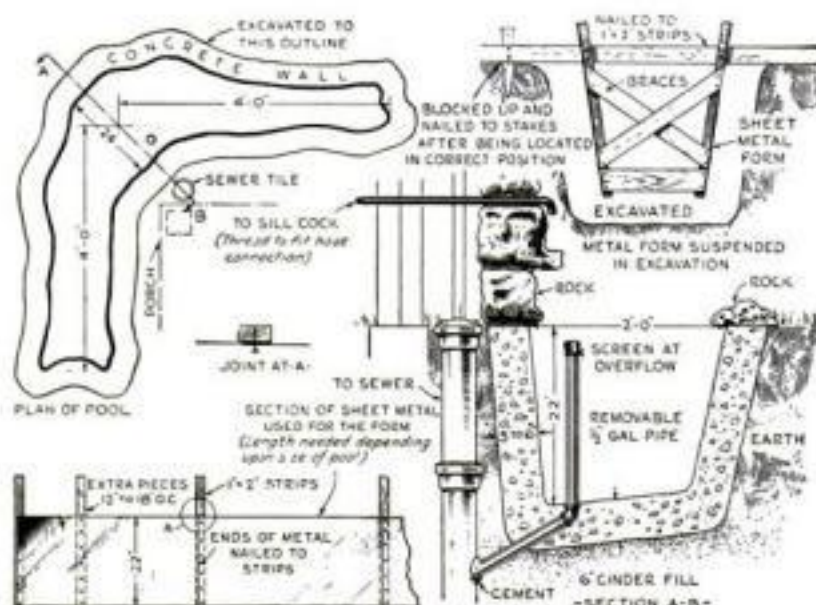
An overflow pipe and drain may be installed as shown, or the water may be siphoned to the basement drain through a garden hose. The overflow can also be disposed of by excavating a hole about 2 by 2 by 2 ft. outside the pool wall and filling it with rock or gravel, then covering the

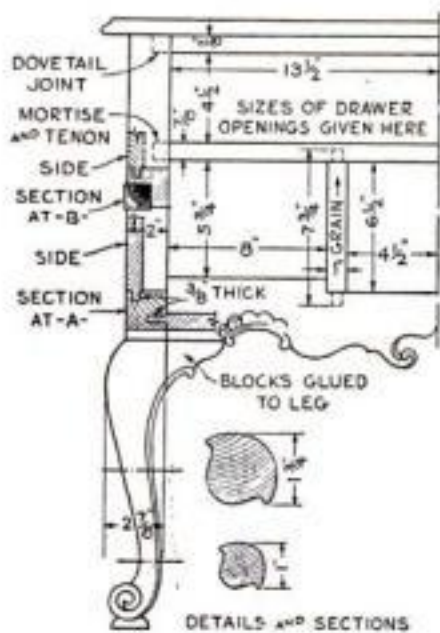
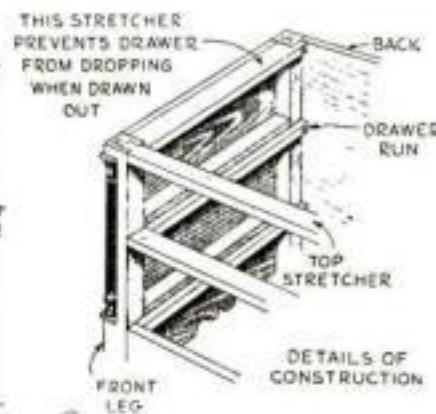
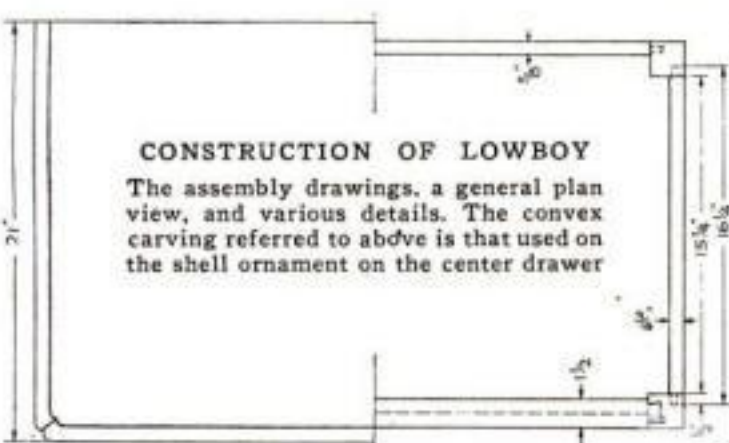
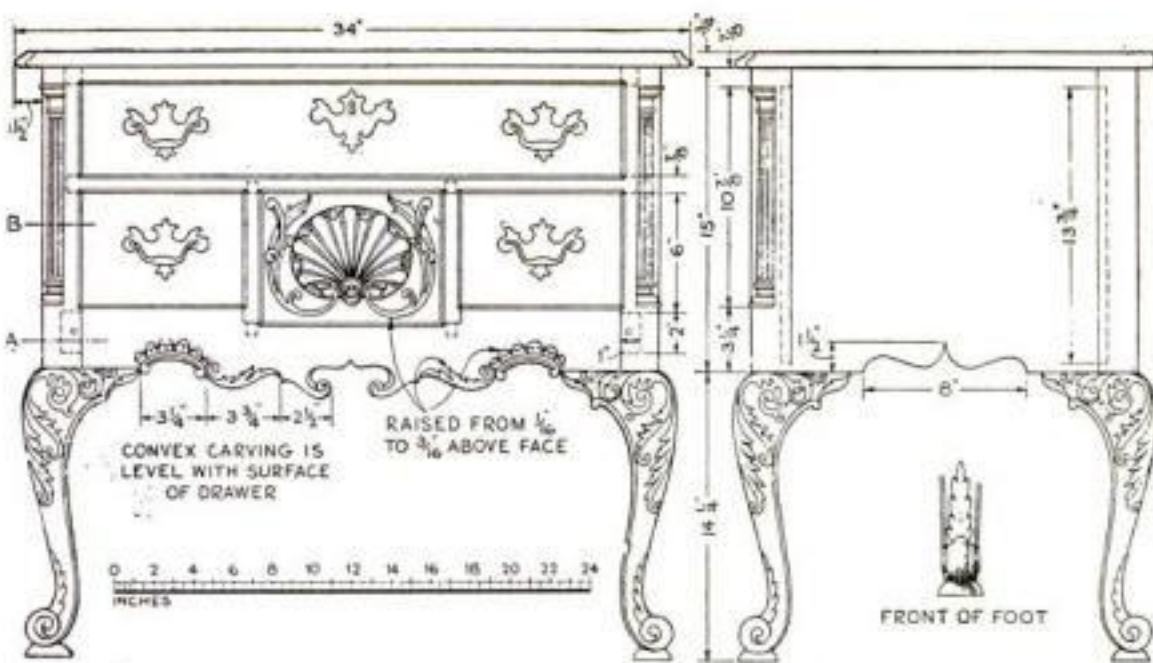
surface with sod again except at the point where the water runs off from the pool. Water will gradually seep into the soil.

In building up the back wall, almost any variety of rocks may be used, but keep the appearance as natural as possible. A hose from a convenient sill cock or faucet will serve as a source of water supply unless a permanent piped connection is desired.—WILLIAM T. WELD.

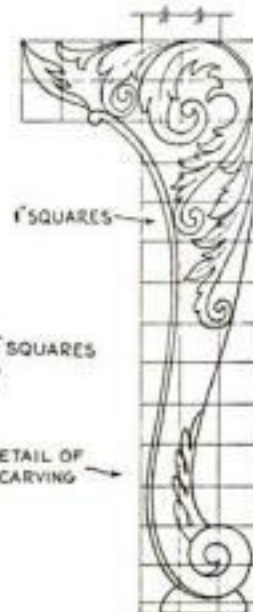


At left: The pool with vine-covered rocks at the back. In circle: What it hides. At right: Plan view, forms, and cross section of finished pool





QUARTER COLUMN DETAIL



List of Materials

MAHOGANY

Legs—4 pc. 3" x 3" x 29 1/4"
Blocks glued to legs—8 pc. 2 1/2" x 3" x 3"
Top—1 pc. 3/4" x 21" x 34"
Ends—2 pc. 3/4" x 16 1/4" x 15"
Upper drawer front—1 pc. 3/4" x 4 3/8" x 27 3/8"
Middle drawer front—1 pc. 1" x 6 3/8" x 9 3/8"
End drawer fronts—2 pc. 3/4" x 6 1/8" x 8 3/8"
Carved skirt—1 pc. 7/8" x 4 3/8" x 29"
Middle stretcher—1 pc. 7/8" x 1 1/2" x 29"
Upper stretcher—1 pc. 3/8" x 1 1/2" x 29"
Vertical divisions between middle and end drawers—2 pc. 3/4" x 1" x 7 3/4"
Quarter columns—cut two from turned column 2" diam. x 10 3/4"
Abacus and base of quarter columns—4 pc. 1/4" x 1 1/8" x 1 1/8"

POPLAR

Back of lowboy—1 pc. 3/8" x 15" x 28"
Drawer sides: Upper drawer—2 pc. 1/2" x 4 1/2" x 18 3/8"; middle drawer—2 pc. 1/2" x 6 1/2" x 18 3/8"; end drawers—4 pc. 1/2" x 5 3/4" x 18 3/8"
Drawer bottoms (plywood): Upper drawer—1 pc. 3/8" x 18 1/4" x 26 1/4"; middle drawer—1 pc. 3/8" x 8 1/2" x 18 1/4"; end drawers—2 pc. 3/8" x 7 1/2" x 18 1/4"
Drawer backs (poplar): Upper drawer—1 pc. 3/8" x 3 3/4" x 26 1/2"; middle drawer—1 pc. 3/8" x 5 3/4" x 8 1/2"; end drawers—2 pc. 3/8" x 5" x 7 1/2"

formed in such a manner as to give adequate leg room under the table. Pieces of the type illustrated, however, are better suited to other purposes. They may be placed in a hallway under a mirror, used as a chest for the family silver or as a serving table in the dining room, or put to other uses in the living room or even in the library.

The drawings show a design that will grace the finest home. It has traces of rococo ornament, which Chippendale adapted from the Louis XV style and to which he was apparently quite partial. The shell on the center drawer is a striking, though tasteful, decorative element, and constitutes the center of greatest interest. It must, of course, be carved from the solid drawer front.

The drawings contain sufficient information to enable an experienced amateur woodworker to construct the piece. It is one that the advanced craftsman should particularly enjoy building because of the opportunity to match his skill against that of the great cabinetmakers of the past.

HERE IS A

Chippendale Lowboy

THAT CHALLENGES YOU TO MATCH YOUR SKILL AGAINST THAT OF OLD-TIME CABINET MAKERS

THE beautiful lowboys built by Chippendale or craftsmen of the Chippendale school are numbered among the finest examples of eighteenth-century cabinetwork. The best ones are jewels of the cabinetmaker's art. Besides being decorative, they are admirably suited to a number of practical purposes.

It is said that lowboys were originally

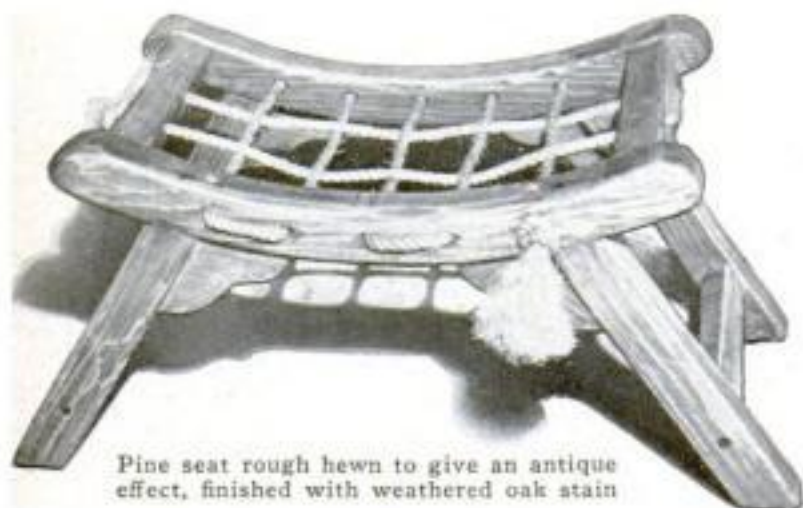
By Franklin H. Gottshall

used as dressing tables. Perhaps this is true, but a lowboy of Chippendale design has so low a skirt that sitting close to the mirror hung above it would be quite impossible. Earlier lowboys, of the Queen Anne, or William and Mary styles, were used for this purpose, the skirts being



Hand-carved lowboy in Chippendale style

Low Seat Designed in Medieval Style



Pine seat rough hewn to give an antique effect, finished with weathered oak stain

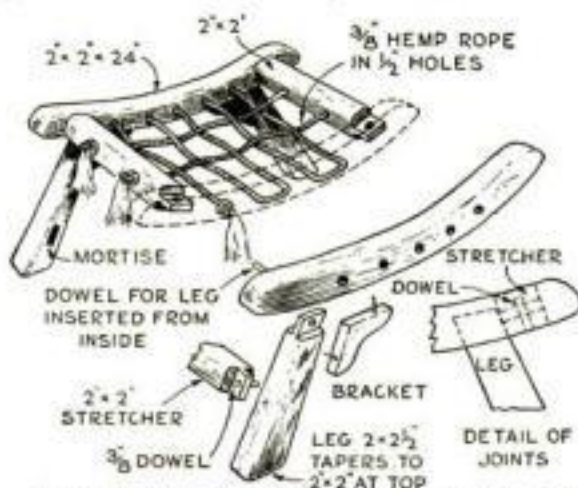
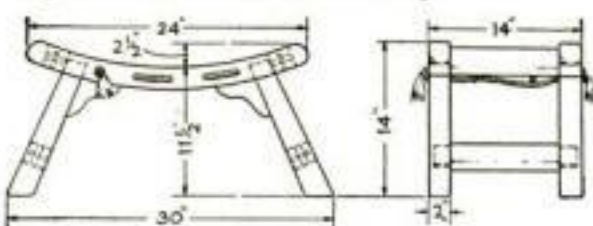
MEDIEVAL in design, this unusual seat is not only decorative, but also surprisingly comfortable, even without a cushion. It was suggested by a sixteenth century chair, although the construction has been modified to make it easier to build in the home workshop. It was designed by Durlin Brayton, an artist, of Laguna Beach, Calif., who has a number of unusual pieces of furniture to his credit.

All the joints are of the mortise-and-tenon type and pinned with dowels except the curved brackets bracing the legs, which are secured with long screws. Oak is the preferred material, though other woods may be used. The curved members for the seat frame are cut from full 2 by 4 in. stock. This can be done with a compass saw, if a band saw or a heavy duty jig saw is not available. The legs are tapered on two sides, as indicated. The stretchers are of 2 by 2 in. (net) stock.

Note that the dowels through the tenons are in each case put in from the inside or the underside so they will not be conspicuous, and the holes bored for them do not

go entirely through frame members or legs. Glue is used in all joints, care being taken to wipe away all excess. Round off all corners as if from long usage. The seat itself is of $\frac{3}{8}$ -in. hemp rope.

An attractive finish is a weathered oak stain well rubbed with furniture wax. The piece will be more effective if the wood is first roughened to an antique, time-worn surface with a stiff wire brush. The original seat made by Mr. Brayton, which is shown in the photograph above, is of pine, but it was antiqued and stained in this way.



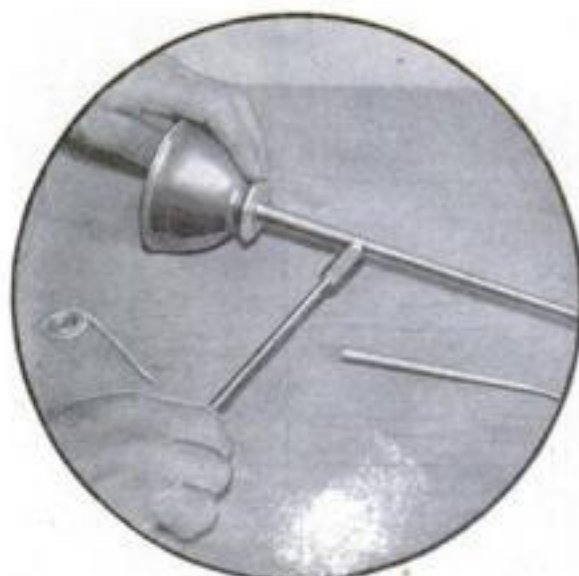
How to construct the seat. The edges are rounded freely to give an appearance of age



KILLING LAWN WEEDS WITHOUT STOOPING

CUTTING or pulling such objectionable weeds as the dandelion from a lawn usually does more harm than good. Unless the entire plant is killed or removed, the root will only spread, and two weeds will come up where one grew before. An easy way to eradicate these weeds is by killing them with gasoline by the method illustrated above.

An ordinary oil can is used, the spout being cut in two and a length of copper tubing from an old automobile gasoline line soldered in. It is then a simple matter to walk about the lawn and, without stooping, to apply a few drops of gasoline to the crown of each weed. After one or two applications, most of them will turn black and die.—L. C. PELTIER.



The applicator is made by soldering copper tubing to the cut-off spout of an oil can

CARDS AID IN PERSPECTIVE DRAWING

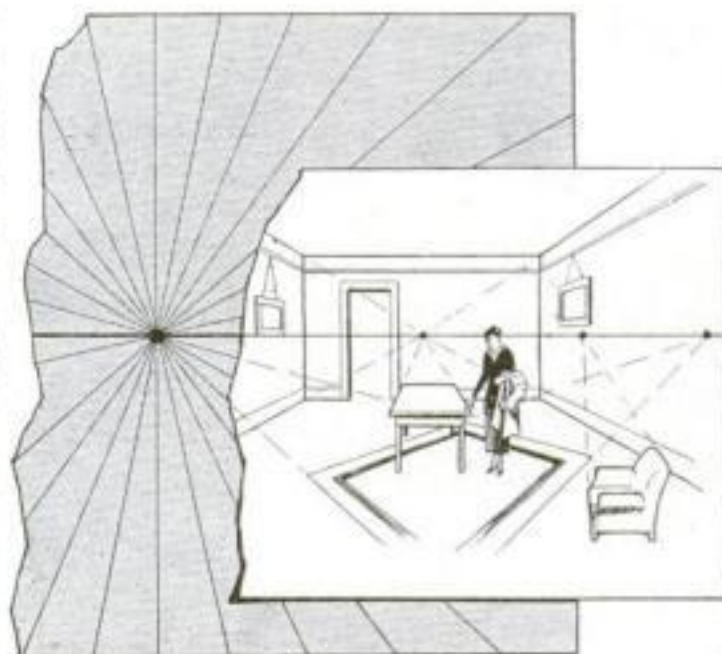
DRAFTSMEN, cartoonists, illustrators, and layout men, who daily encounter the problem of determining actual perspective without loss of time, can save much work by making a series of cards similar to the one illustrated. The cards vary in widths according to each individual's work. Tracing paper bearing the drawing is then merely laid upon the card selected, and the perspective of each object determined by following the lines.

The heavy line running through the center is the horizon. Various vanishing points, their positions depending upon the arrangement of figures in the drawing, can be easily ascertained by shifting the tracing along the horizon and marking off the vanishing points with a pencil.

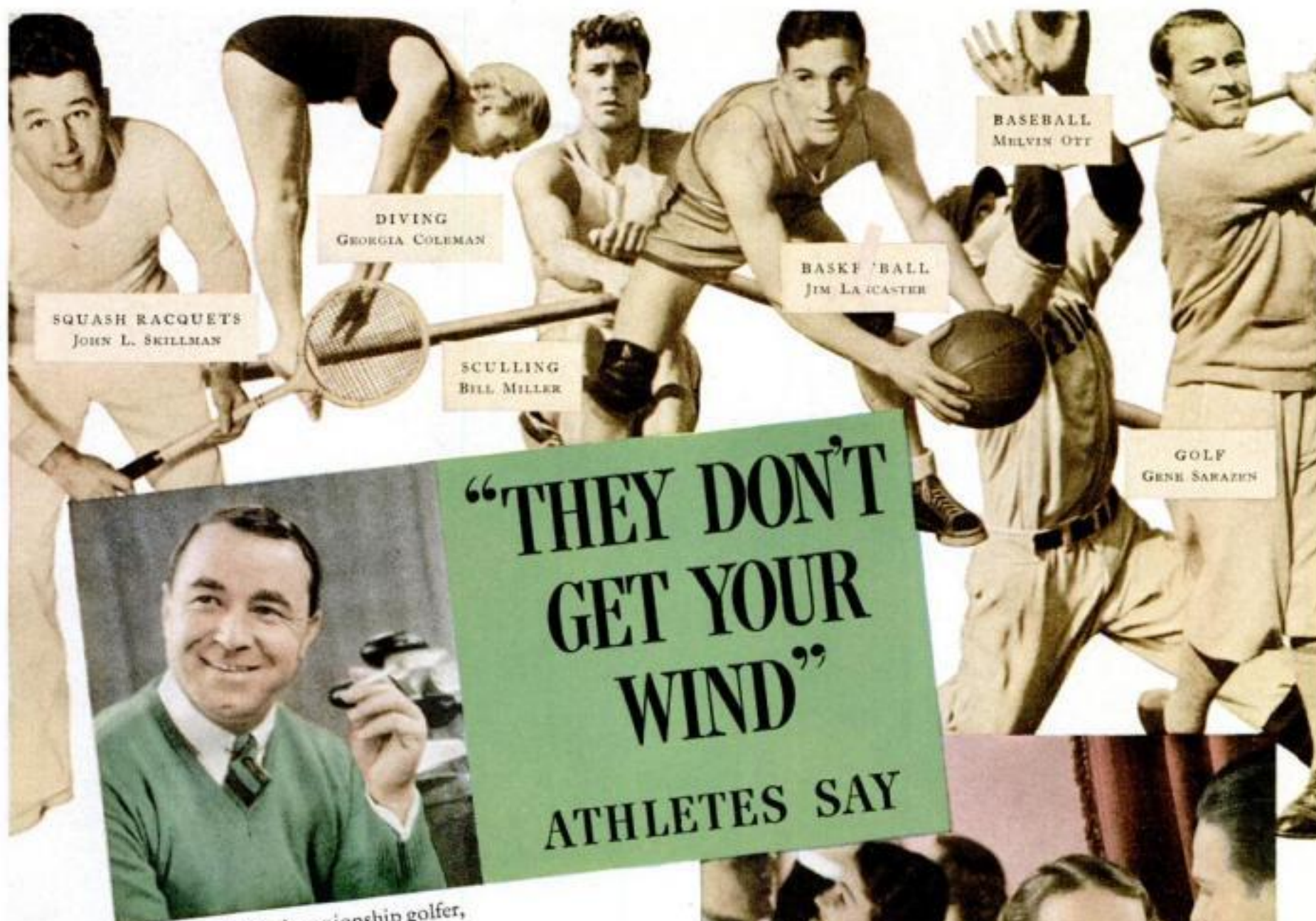
The author has found it advisable to coat each card with a heavy spraying of artist's fixative. This protects the cards from damage.

The value of this idea is at-

tested by the fact that it has long been used by Robert Blickenderfer, an artist on the "New York Sun."—JOSEPH CREAMER.



When the drawing has been roughly sketched on tracing paper, it is laid on a card for truing the perspective



SQUASH RACQUETS
JOHN L. SKILLMAN

DIVING
GEORGIA COLEMAN

SCULLING
BILL MILLER

BASKETBALL
JIM LANCASTER

BASEBALL
MELVIN OTT

GOLF
GENE SARAZEN

**"THEY DON'T
GET YOUR
WIND"
ATHLETES SAY**

GENE SARAZEN, championship golfer,
who has smoked Camels for years

*The mild cigarette the athletes smoke
is the mild cigarette for YOU!*

A cigarette so mild you can smoke all you want—that's what athletes say about Camels. And when a champion talks about "condition"—"wind"—healthy nerves—real tobacco mildness—he knows what he's talking about.

Listen to Gene Sarazen. "Traveling and playing as much as I do—I have to keep in condition. I smoke Camels steadily. They're so mild they never get my 'wind' or nerves."

Other athletes back him up. "I smoke all I want and yet keep in top condition; I smoke Camels and only Camels," says Mel Ott, home-run hitter of the New York

Giants. Georgia Coleman, Olympic champion diver, says: "Camels don't cut down on my 'wind.'" Bill Miller, outstanding oarsman; Jim Lancaster, N. Y. U.'s 1934 basketball captain; John Skillman, squash champion—hundreds of sports stars smoke Camels regularly and report that Camels never get their "wind."

What this mildness means to you!

It means you can smoke Camels all you want. Athletes have made this discovery: Camel's costlier tobaccos are so mild, they can smoke them as often as they please, without disturbing their "wind" or nerves.



CONDITION IS IMPORTANT TO YOU—on vacation, in the office, at home. You can keep "in condition," yet smoke all you please. Athletes say: "Camels never get your wind."

**SO MILD
YOU CAN SMOKE
ALL YOU WANT!**



© 1935, R. J. REYNOLDS TOB. CO.

Camels COSTLIER TOBACCOS

● Camels are made from finer, MORE EXPENSIVE TOBACCOS—Turkish and Domestic—than any other popular brand.

(Signed) R. J. REYNOLDS TOBACCO COMPANY, Winston-Salem, N.C.

IT'S A REVOLUTIONARY NEW KIND OF SUMMER OIL

Lasts far longer
than any oil you ever
used before

REMEMBER the day you drove
your first "high compression,"
high-speed car?

You knew that something had
happened to the automobile!

Today you can have another
driving thrill...with a new motor oil!

Have your crankcase filled with
the new Summer Mobiloil. Watch.
You'll notice a new responsiveness
in your engine. Listen. It hums a
new, a sweeter tune.

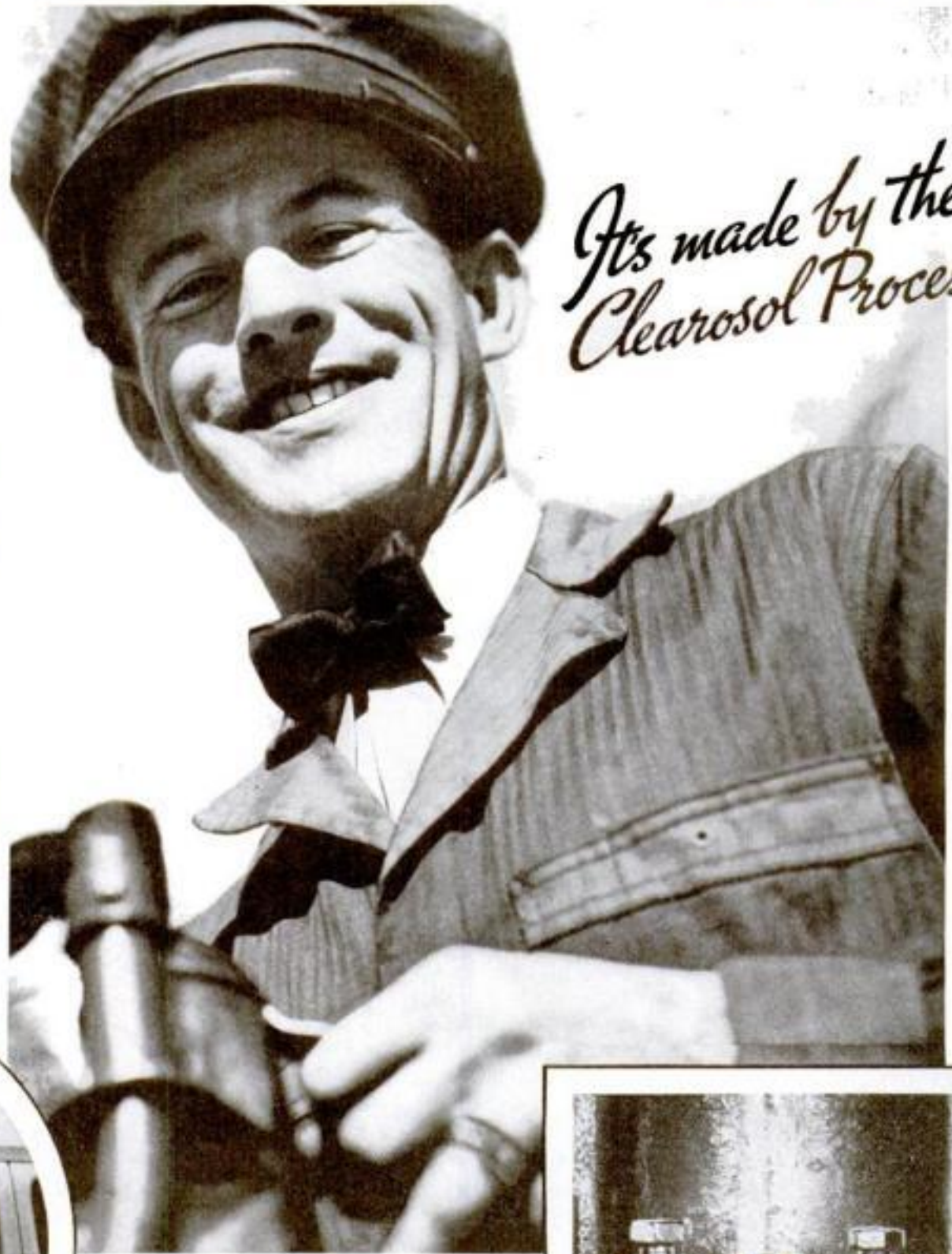
Let us make this promise . . .

Drive 1,000 miles with Mobiloil
and you'll say, "I can't afford to
use anything else." You go farther,
faster...yet consume *less* oil!

Stick to this new Mobiloil all
Summer...and next Fall you'll
find your engine more like new
than you'd believe possible!

Why take less than this for your
money? Change to Mobiloil now.
SOCONY-VACUUM OIL CO., INC.

*It's made by the
Clearosol Process*



THERE'S ABSOLUTELY no advance in
price for this new kind of Mobiloil. It's
the first Summer oil made by Socony-
Vacuum's famous Clearosol Process
...thoroughly cleansed of impurities that
have always defied refining. Sold in
Grades A, AF, B and BB...for all cars
...at the sign of the Flying Red Horse.

Mobiloil

AT THE SIGN OF THE FLYING RED HORSE



100 HOURS of operation on ordinary oil
coated engine valve-chamber with gum
... formed by impurities left in the oil.



AFTER 100 HOURS on new Mobiloil, en-
gine was still clean. This new motor oil
is 100% free of elements that form gum.

NEW LOW-WING Transport Plane Model

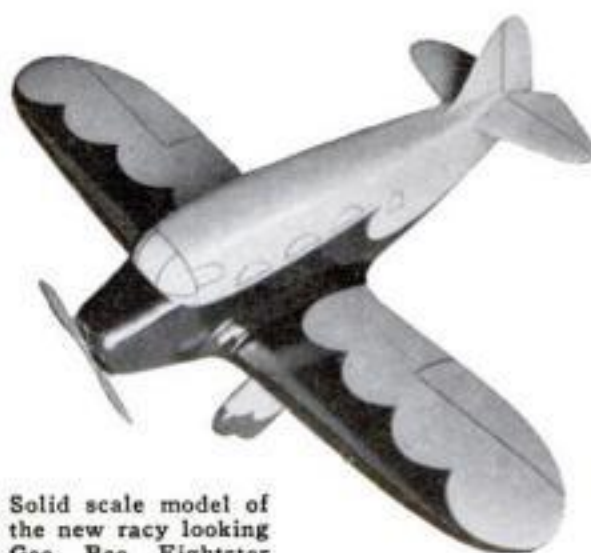
MADE WITH ONLY EIGHT UNITS

ONLY eight units are required for making this simplified scale model of the new Gee Bee Eightster transport monoplane. This is the smallest number of parts to which any model in the present series has been reduced. The closest to it was a solid model of the Junkers airplane *Bremen* (P.S.M., Feb. '32, p. 110), which had thirteen pieces.

Although the Eightster is similar in design to the small, short, stubby speed planes made by the same manufacturer, it is intended for transport service and has a range of about 800 miles. It is powered with a radial engine rated at 700 H.P.

The scale of the model in relation to the real plane is $\frac{3}{8}$ in. equals 1 ft. The fuselage is made in one piece, although if preferred, the nose cowl could be turned on the lathe as a separate piece. The recess in the cowl is cut with a knife and small chisel, then smoothed with sandpaper. The wing roots are glued on and putty used to form the fillets, after the surface has been roughened with a sharp tool.

By Donald W. Clark



Solid scale model of the new racy looking Gee Bee Eightster

Putty should not be used, however, if the finish is to be lacquer; in that case a composition wood of the plastic type is preferable.



The units before assembling. Propeller and vertical tail are metal, all other parts wood

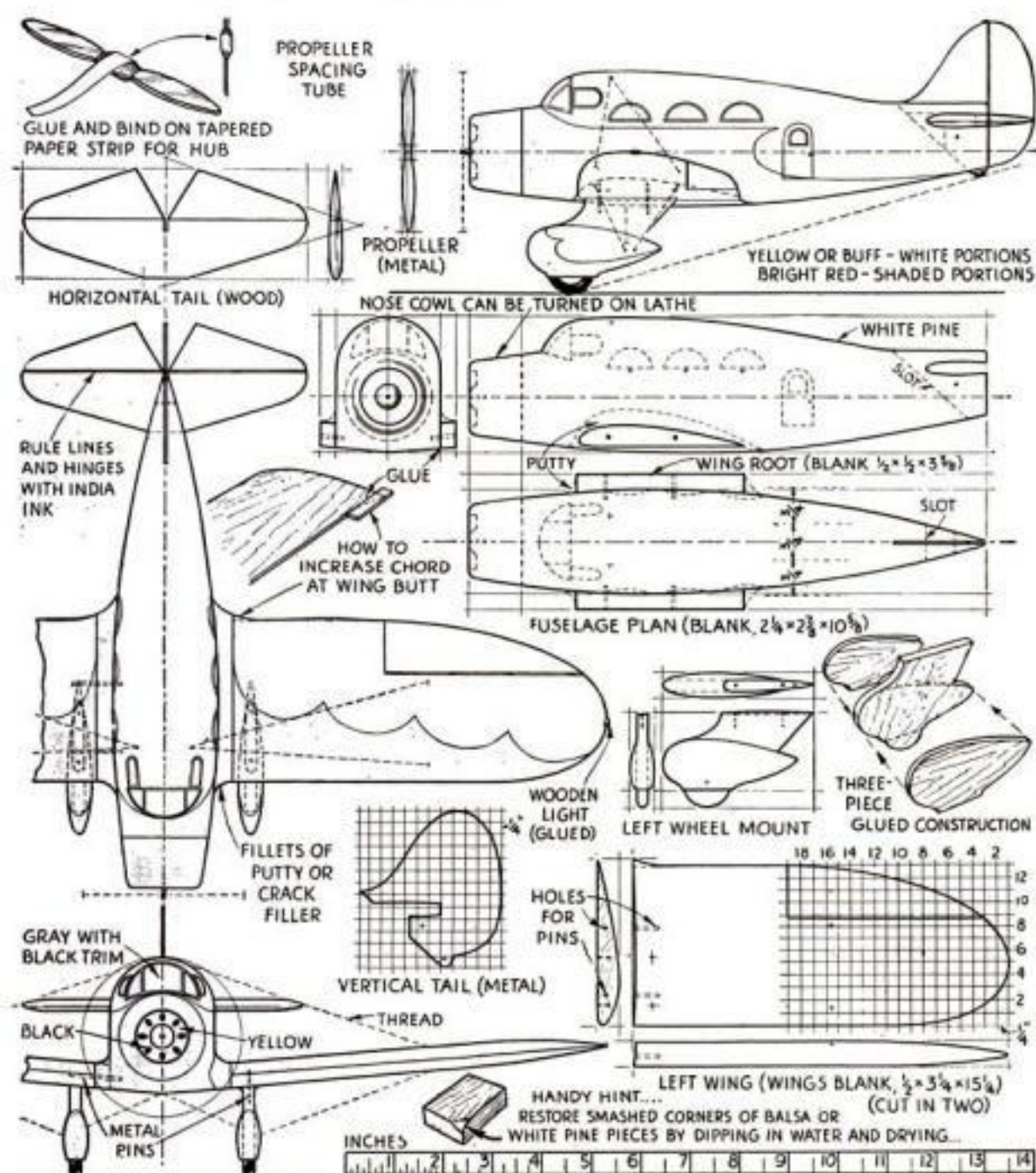
The tail parts are made of wood and metal as indicated. The wheel mounts are each shaped from a single piece, but the builder can use the alternative three-piece construction sketched for building up the wheel-mount blanks, if he prefers.

The correct shape for the wing tips can be laid out easily by the use of squares. Each square represents $\frac{1}{4}$ in., but if you draw in every other line on your full-size pattern, making the squares $\frac{1}{2}$ in., it will probably be sufficient. Note in one of the perspective sketches how the trailing edge at the butt of the wing is obtained by adding a piece of wood.

When the model is assembled, apply a filler coat of paint. Then cut out paper patterns to aid in drawing pencil lines on the model at the boundaries of the different colors. Use yellow or buff on those portions of the model which have been left white in the assembly drawings, and bright red for the shaded parts. Apply the red with extreme care to give a clean-cut effect. The door outline can be cut in with a knife point. Paint the windows gray and use black for the trim.



Using the pins in the wing stub to mark where to drill holes in the end of the wing



Side, top, and front views, and details of fuselage, wings, and other parts, with an inch scale

PRESERVING YOUR SKIS

Don't throw your skis in the garage or basement to lie uncared for all summer. Go over them carefully and remove all the wax. Then treat them liberally with raw linseed oil and repeat the treatment a couple of weeks later. Inspect the fittings carefully. Cover any ironwork with a thin coat of vaseline. Then place a block of wood between the footplates of the two skis and lash them together, bottom to bottom. The block should be at least 2 in. thick. High-grade skis are specially made with this bend in them, and its preservation is important.

Put the skis away, preferably in a cool, dry cellar, standing straight up on their points, not on their heels, so as to keep the upturn at the points. A week or so before you expect to use them, go over the straps, remove the vaseline and put on fresh wax.—DOUGLAS LEECHMAN.

INGENIOUS TRICKS IN Table-Top Photography

*How to take pictures as
real as life by using
miniature models... The
final prints are made
from paper negatives*

means for holding the film inside at one end and, at the other end, with a lens made by piercing a piece of shim brass with a needle point.

For the proper effect of perspective, the shorter the focal length the better. To have used a 12-in. lens for the factory picture seems at variance with this, but you will notice that the effect of linear perspective is not a part of this photograph. The same picture could have been made with the ten-cent pinhole camera, the only difference being that three seconds was sufficient exposure with the lens, whereas the pinhole would have required thirty or more minutes.

In order to direct and control the light and study your effects, it is best to use electric lamps for lighting the model. If you wish to do all the work personally, you will need materials and equipment for developing the negative and making a print. An enlarging camera can be used to advantage.

Now let's get to work. First, determine what your subject will be and get a clear mental picture of it. Making a rough sketch will help. The makeup of one of my models has been described. In the picture of the destroyer, the model was one built from [\(Continued on page 88\)](#)



United States destroyer in a heavy storm. This is really a picture of a model made from *Popular Science Monthly* blueprints and set in a sea of crinkled red wax paper. The spray is fluffy cotton; the sky, a piece of composition board

TABLE-TOP photography is the art of taking pictures of models or other miniature subjects that have been so arranged as to give a result suggestive of real life. Such photos may be divided in two classes. In one, the subject is represented as exactly what it is, but is so arranged as to suggest reality. It is the type most often seen in advertisements. In the other class, to which this article relates, the means and methods are concealed in an effort to approach actual realism, as in the example illustrated above. This is a fascinating field for amateur photographers and model makers.

Thirty or forty persons, including artists and photographers, who have seen the original print reproduced above and the two on page 88, have accepted them as photographs of drawings or mezzotints. Not one has suspected that the subjects were small enough to put on top of a card table.

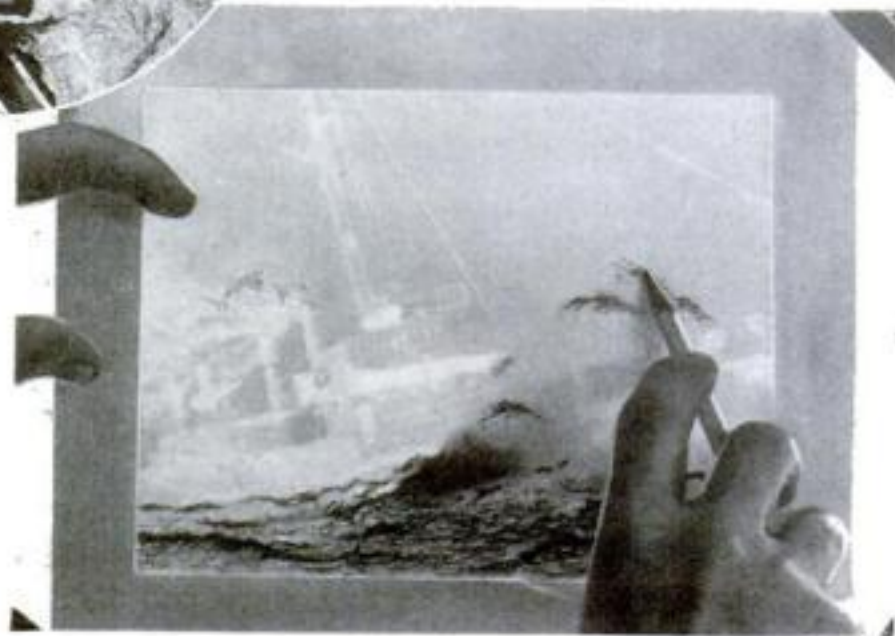
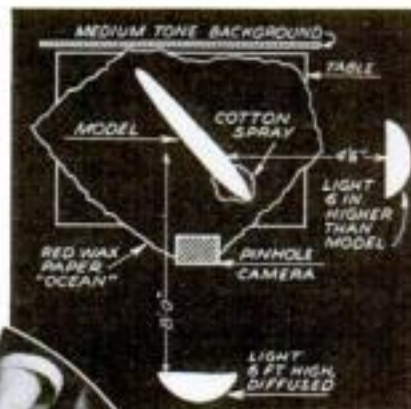
Elaborate models and expensive photographic equipment are not essential. The factory scene on page 88, for example, is nothing but a sheet of tinfoil for the foreground, a piece of black cardboard for the buildings, two black paper tubes, a white sheet for the sky, and clouds of cotton hanging from a string. As for the cameras, the old-time ship (page 88) was made with a small hand camera of the bellows type on a film about 4 by 5 in. The factory was taken with a 12-in. lens on a 5 by 7 in. film, and the destroyer picture on this page was made on one quarter of a 5 by 7 in. film with a homemade pinhole camera that cost ten cents. A pinhole camera is nothing but a light-tight box provided with

*By Garrett
I. Johnson*



Arranging the set-up for the storm picture. The diagram shows positions of the model, background, camera, and lamps. A pinhole camera was used in this instance, but any small camera will do

Paper negative from which the final print was made. The highlights on the spray and the white caps were brought out by using a black pencil on back of negative



RECOMAR the all-purpose Kodak for Fans

SPEED snapshots, portraits, copies, wide-angle and telephoto pictures—this one camera makes them all. Kodak Recomar has a high-speed Compur shutter that splits seconds to 1/250 (1/200 on the "33") . . . a built-in self timer. And the brilliant *f*.4.5 Anastigmat lens lets you make snapshots in difficult light.

Completely equipped, the Recomar has double-extension bellows . . . micrometer screw focusing . . . hooded ground-glass back . . . rising front . . . both eye-level and reflecting finders . . . spirit level. Supplementary wide-angle and long-focus lenses extra.

Model "18"—for 2¼ x 3¼-inch pictures, \$54 . . . model "33"—for 3¼ x 4¼-inch pictures, \$63.



A WIDE CHOICE OF FILMS . . . every Recomar uses Film Packs, Cut Film or Plates. When loaded with "SS" Film and used with Photo-flood bulbs, the Recomars are ideal for snapshots at night. For those who want extreme speed, Hypersensitive plates are available.

Three supplementary lenses are available for the Recomars—increasing the scope of your camera as shown below. These lenses require no adjustments . . . merely slip on over the regular lens. Cost, \$3.50 each.



The long, double-extension bellows allows you to make close-ups . . . copies. The hooded ground-glass back insures micrometer-sharp focus.



The wide-angle supplementary lens increases the angle of view 23% on the Recomar "33" . . . 17% on the "18."



Normally—the Recomars cover this field. The Recomar "33" has a 135 mm. lens . . . the "18"—105 mm. lens.



With supplementary lens A—Recomar "33" gives a 33% increase in the image size . . . the "18," a 28% increase.



With supplementary lens B—Recomar "33" gives a 70% increase in the image size . . . the "18," a 62% increase.

JUST OFF THE PRESS—1935 KODAK CATALOG



Complete information about Kodaks, enlargers, dark-room outfits, equipment. Send for your copy today. Eastman Kodak Company, Rochester, N. Y.

Name _____

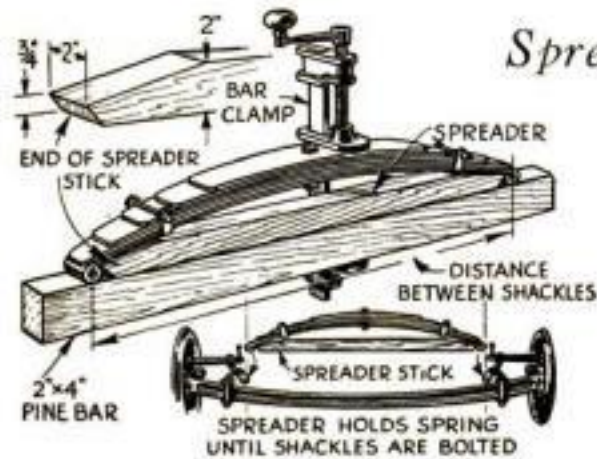
Address _____

City _____ State _____

P. S.—6-35

Helpful Hints FOR MOTORISTS

Experienced Drivers Among Our Readers
Offer You These Valuable Suggestions



How to make and use the spring spreader

Spreader Stick for Springs

RPAIRS to springs can be simplified by making use of a spreader stick similar to the one shown. To fit a spring back into place between its shackles, place it on a flat piece of wood and, by means of a bar clamp, compress it until the holes at the ends just fit the spacing of the shackles. Then, fit the spreader bar in place and release the clamp. The spreader will hold the flattened spring rigid until the shackle bolts can be placed.—M. J. H.

Extra Mirror Mounted on Back of Sun Visor

SUN VISORS often are so placed that they cannot be used without completely hiding the rear-view mirror. To overcome this, the writer mounted an additional mirror of the back side of the driver's visor in his car. The mirror was cemented in place by first applying a sealing coat of shellac to both the visor and the back of the mirror and then using cold or liquid solder such as can be obtained in five-and-ten-cent stores.—E. D.

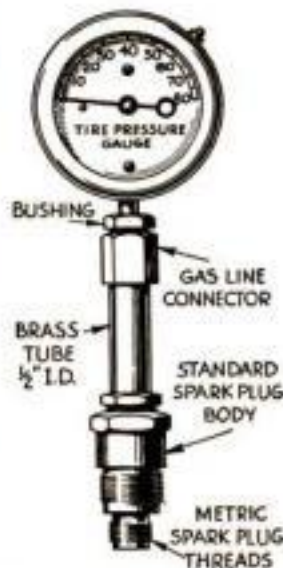


Rear-view mirror mounted on a sun visor

Compression Gauge Made from Odds and Ends



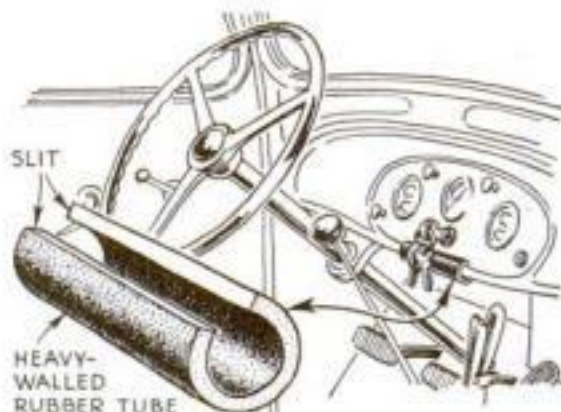
Homemade compression gauge fits any spark-plug hole



A SURPRISINGLY accurate compression gauge can be made from an ordinary tire-pressure gauge, some brass tube, two spark-plug bodies, and a few other odds and ends. Fit the brass tube to the outlet of the gauge by using a gas line connector, thread the other end of the tube, and, after cutting threads on the insides of a complete standard spark-plug body and the threaded portion of a metric plug, screw them in place. In use, it is not necessary to screw the gauge tightly into the spark-plug holes; a few turns will be enough. The reading of the gauge will tell a graphic story of ring condition and compression.—C. E. M.

Buffer of Rubber Tubing Silences Rattling Keys

IF THE key ring on which you keep your ignition key rattles against the dashboard, you can silence it by slitting a short section of rubber tubing and slipping it over the decorative beading at the bottom edge of the panel. The tubing forms a cushion against which the keys can strike without making a noise. Select thick-walled tubing for the job; its springiness will keep it in place.—E. H. K.



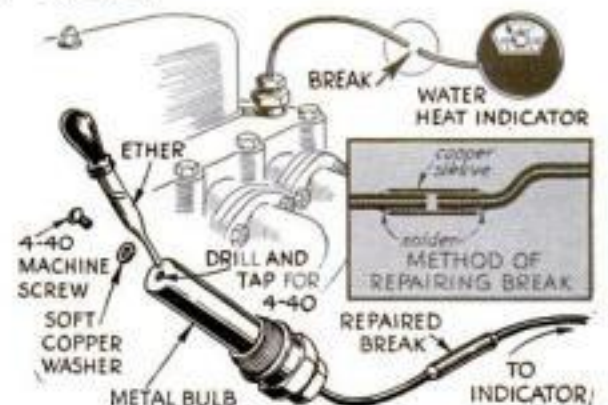
Rubber tubing slips over decorative panel bead



Chalk mark on tire casing helps to locate puncture

Easy Method Locates Cause of Puncture

WITH a piece of chalk, you can easily locate the nail or other sharp object that has punctured a tire. Before removing the tire from its rim, place a large chalk mark on the side wall of the shoe directly opposite the valve stem. Then remove the tube, and find the puncture by the usual water-trough method. After applying the patch, hold the tube over the tire with the valve in its former position as indicated by the chalk mark. The location of the patch will tell you where to look on the casing for the cause of the puncture.—R. O. S.



How tubing break is repaired and ether replaced

Repairing Leak in Tube of Dash Heat Indicator

IF YOUR dash-type heat indicator suddenly fails to function, a break in the copper tube connecting the gauge with the expansion bulb in the motor head probably is causing the trouble. Even the smallest crack in this line will allow the ether originally contained in the bulb to escape. After joining the tube by soldering the two severed ends into a tight-fitting copper sleeve as shown, replace the ether. To do this, drill a small hole in the bottom of the bulb, tap it to take a small machine screw, and then, with an ordinary medicine dropper, squirt a dram (about one half of the dropper full) of ether into the bulb. Finally, seal it quickly with a short machine screw fitted with a soft copper washer. The instrument can be tested by plunging the bulb into boiling water and reading the gauge.—R. C. A.

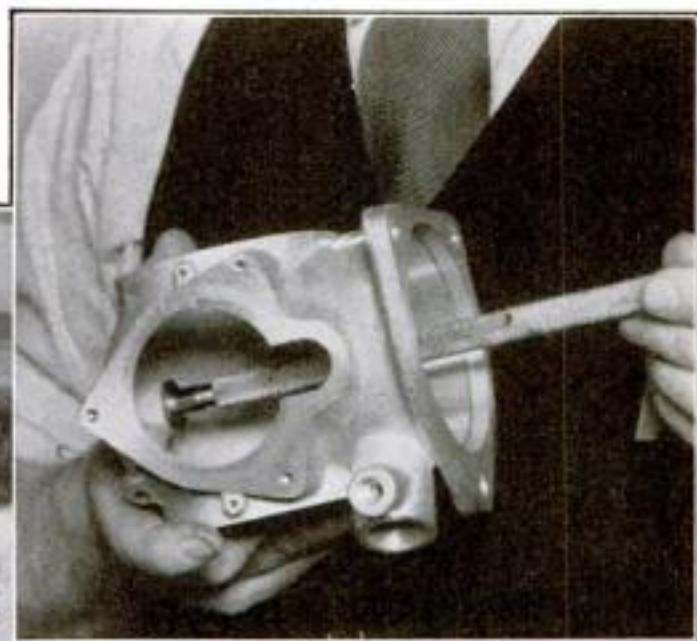
THE VITAL SPARK

★ THE accurate timing and control of the spark—and maximum intensity—are essential to high efficiency in engine performance. To make it easy for Ford owners to keep the electrical system in top-notch condition, the Ford Motor Company includes vital electrical units in the low-cost Ford Parts Exchange Plan.

The owner of a V-8 can obtain a Ford factory-reconditioned distributor for only seven per cent more than it would cost to have new ignition points installed. The exchange unit has been completely rebuilt with new ignition points. Worn parts are replaced—all working parts have the same close tolerances as in a new distributor.

Ford owners can also secure a Ford factory-reconditioned generator installed for actually less than the cost to replace the armature, field coils and brushes alone. Every detail of the exchange generator has been accurately checked.

*Checking the Fit of
Distributor Housing
Front Bearing*



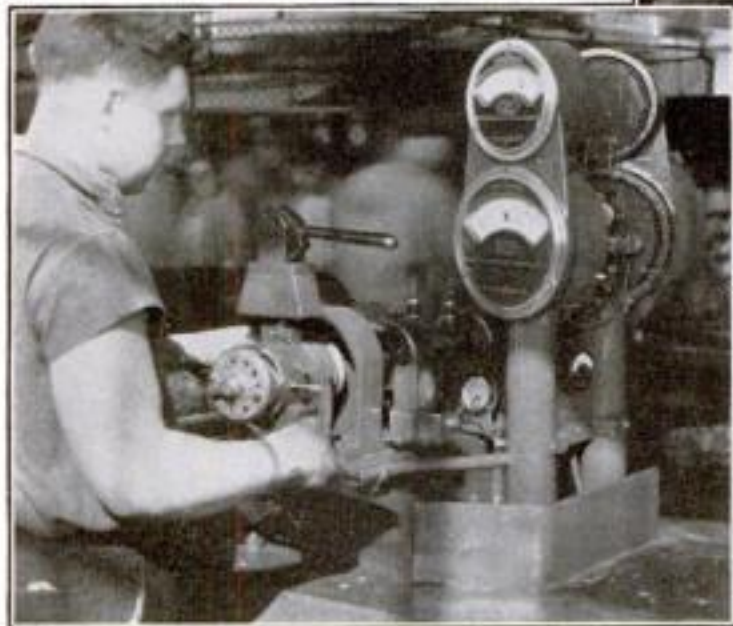
*Adjusting Distributor Vacuum Brake
on Final Test*

In most cases the armature is new. The rear bearing must measure within the same one-thousandth of an inch limit as a new one or it is replaced. The new bearings are accurately sized in a 4-ton press—an exclusive factory operation. The tapered-roller front bearings are carefully inspected and adjusted.

Brushes are new and the springs are tested for tension. The factory-reconditioned generator has the same efficiency as a new generator.

The Ford Parts Exchange Plan includes the Engine Cylinder Assembly and many other units.

This plan not only actually saves money for the owners of Ford cars and Ford trucks but it helps them in the maintenance of the same high standard of Ford performance as well.



Testing Generator for Current Output



*Assembling Reconditioned
Generators*



FORD MOTOR COMPANY, DEARBORN, MICHIGAN

I ALWAYS WAX MY CAR

for
lasting
beauty

...and I use

Du Pont Duco-Wax

THE way to keep a car beautiful for months, and protect the finish against fading, is to WAX it. That's what thousands of car owners say!

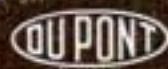
Du Pont Duco-Wax is easy to apply. It keeps out dirt . . . prevents weathering . . . seals in the beauty. Its occasional use will keep any car finish beautiful for years.

TRIAL OFFER. Try Duco-Wax yourself. A generous sample will be sent you FREE if you tear out this advertisement, and mail it with your name and address (and 6¢ in stamps for postage) to DU PONT Dept. S-52, Wilmington, Del.

(Offer good only in U. S. and Canada)



**DU PONT
DUCO-WAX**



No danger of spilling with this tray

WITH its decorative double deck for holding beverage glasses, the tray illustrated is a colorful and useful accessory. The design is especially attractive when enameled in Chinese red and black or other colors, but it can be finished with stain and varnish.

This project is especially adapted to duplication for sales purposes. The plywood shelves can be nailed together, a dozen or more in a pile, and bored with an expansive bit or a large, solid bit in a drill press, and the outlines may be cut with a band saw.

The layout is geometrical, so take all measurements from the center lines. Note that the curves of the outer edges are centered $\frac{1}{2}$ in. back of the pocket-hole centers on the large



An additional softness of design is imparted by rounding the edges. The easiest way to do this is with a shaper, if one is at hand, or by adapting a drill press for the purpose. Use a $\frac{1}{4}$ -in. cutter for quarter-rounds. Work a shelf from one side, then turn it over and repeat

Working drawings. Note that the four spools supporting the lower shelves have dowels on the lower ends and are bored for dowels in the upper ends

Double-Deck TRAY

holds ten glasses

Rarely will you find a tray that is so interesting to make and at the same time so novel and practical

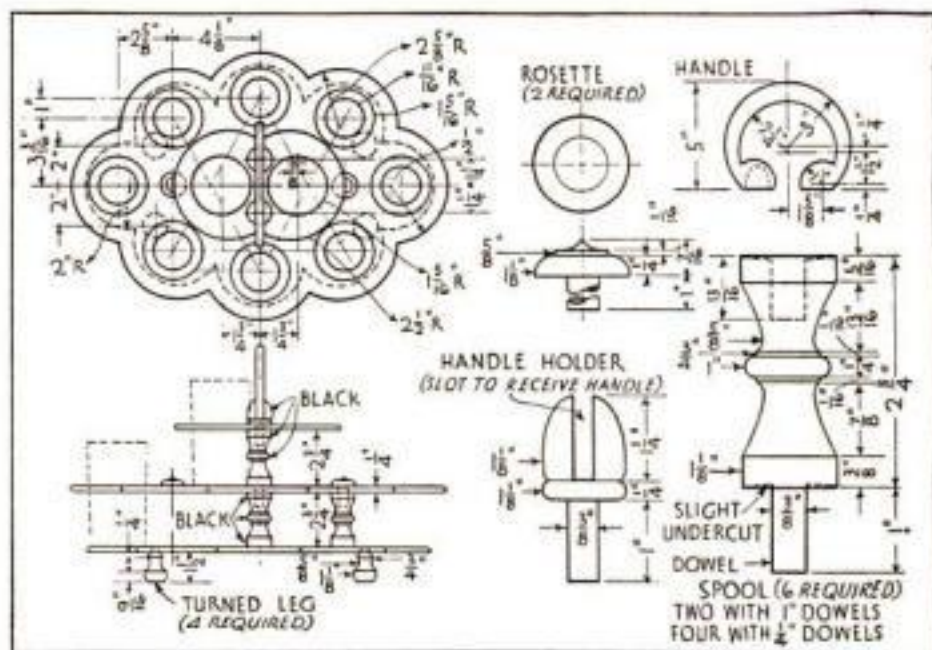


shelves and $\frac{3}{8}$ in. back on the small one. The pocket holes should fit the glasses to be used with about $\frac{1}{8}$ -in. clearance.

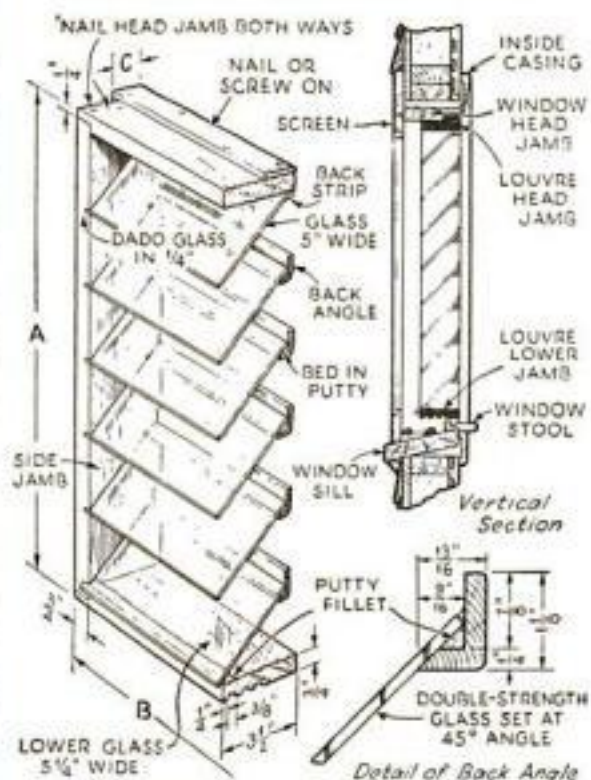
If a steady rest is at hand, the spindles can be turned directly from one piece of full-round stock; but if this lathe attachment is not available, turn the spools, in groups of two each, and the legs and handle clevises from one piece of wood. The rosettes likewise may be turned from one piece. As the foot dowels pass through the lower shelf, round the ends to project as low buttons on the surface. It will be seen that the four spools supporting the lower shelves have $\frac{1}{4}$ in. long dowels on the lower ends and are bored to receive dowels in the upper ends. The other two spools have 1 in. long dowels on the lower ends to fit the holes in the two spools that are set below them.

Paint all parts before assembling. It is convenient to finish the spindles on the lathe, before cutting them apart.

The top handle is a convenience for carrying the tray when gathering up used glasses. When bringing out fresh beverages, the tray is better carried by the ends, so that the hands do not rest above the open tumblers.—E. M. L.



RAINFOOF VENTILATORS FOR ATTIC WINDOWS



How to make a window ventilator with glass louvers. Dimension A should be 1/16 in. less than distance between stool and head stop; B should be 1/16 in. less than distance between side stops; and C should be equal to the thickness of the casement window itself.

WINDOWS in many attics are left open for ventilation during the entire summer. When a sudden storm blows up, however, someone must remember to close them or serious damage from rain may result. The water is very likely to soak through the ceiling plaster and drip into the room below if the windows are not shut.

This damage can be prevented and the windows can be forgotten for the summer if they are fitted with temporary frames containing glass louvers to keep out the rain. The louvers will allow almost as much air and light to pass as if the windows were wide open.

Ventilators of this type can easily be made to suit whatever windows are to be thus safeguarded. The accompanying drawings show one workmanlike way to make them for wooden casement windows. Such ventilators can also be used elsewhere in the house; for example, in a sleeping porch that faces on the street, where translucent glass can be used instead of clear sheets.

When cutting the glass, make the lower sheet 1/4 in. wider than the rest, for a projecting drip. In the construction illustrated, back strips of wood or metal are used to prevent water from blowing in. These strips do not add a great deal to the work and are an additional safeguard.

All wood and metal parts should be painted before assembling. For use with a casement window, the ventilator may be hinged to the window jamb in the same way as the casement, with a fastener to match. Merely by withdrawing the hinge pins, the casement sash may be removed and the ventilator substituted. If outside window screens are not used, screen wire can be tacked over the ventilator on the inside, the edges being hidden by a thin molding, if desired.—L.M.E.

PLUGGING AUGER HOLES

WHEN the exteriors of remodeled houses are painted, it is often necessary to plug large auger holes previously used for pipes or wires. This can be done by hammering in ordinary corks and cutting them off flush with the surface to give a good foundation for the finishing putty.—JAY WOOD.

NEW KIND OF MOTOR OIL ENDS LAST BIG CAUSE OF LOST POWER!

**Finest 100% Pennsylvania Oil,
Refined by New Process, Cuts
Oil Consumption Up to 50%
... Saves Up to 15% on Gasoline...
Reduces Valve and Piston
Ring Troubles 75 to 90%**

THE introduction of New Pennzoil offers motorists a new kind of Pennsylvania oil that solves the last big problem of safe motor lubrication!

Until now all motor oils contained damaging elements that were impossible to remove by previous refining methods. These elements break down under engine heat and form sludge... that gummy substance that forms in *plain oil* after it has been run for a time. It collects on valves and piston rings, and wastes power, oil and gas... sends cars to the repair shop often.

Saves Money 3 Ways

But now comes New Pennzoil, refined by a new process that *removes* these sludge-forming elements... *and saves you money 3 important ways:*

First, with sludge-forming elements removed, New Pennzoil cuts valve and piston ring repairs 75 to 90%—there is no sludge to cause valves to stick or piston rings to leak. *Second*, with sludge eliminated, New Pennzoil's tough film is *tougher*—doesn't burn up under engine heat—cuts oil consumption up to 50%. *Third*, because valves and piston rings work freely, you get better compression, more power. Speed and pick-up are increased. Your car runs smoother, *faster*. You save up to 15% on gasoline!

New Pennzoil costs nothing extra—so get it today from any bonded Pennzoil dealer. Just ask for the correct grade of New Pennzoil for your car.



At left, note sludgy deposits on piston, valves and rings, due to impurities from *plain oil*. Compare with clean piston at right, lubricated with New Pennzoil. No sludge to cause valves to stick and piston rings to leak.

Faulty Lubrication ruins more cars than smash-ups

Look out where you say, "Change the oil and grease the car." Those few words cost car owners more money... ruin more cars... cause more repair bills... than smash-ups.



At least 7 different lubricants are vital to different parts of your car—and Pennzoil dealers, who specialize in the Pennzoil "Safety System" of lubrication are skilled in how to apply them.

FOR COMPLETE "SAFETY SYSTEM" LUBRICATION, LOOK FOR THIS SIGN



Every dealer who displays it can give your car the 7 special lubricants it needs—and save you costly repair bills later on.

THE PENNZOIL COMPANY

Executive Offices
Oil City, Pennsylvania • Los Angeles, California
British American Oil Co., Ltd., Canada

TOUGH-FILM

New PENNZOIL

THE OIL THAT GOES FARTHER... FASTER... SAFER



Member Penn. GradeCrude
Oil Ass'n Permit No. 2



What Words Rhyme With Suffer?

A man who uses dull tools is a duffer. Grinding on a coarse wheel makes them rougher.

Without a good *oilstone*, he's a muffer.

Shop tools for cutting, boring, drilling can be given a keen edge which is tougher. At home, your wife needs a sharpener for the carver, scissors, and kitchen knives—so she won't suffer. You need a Norton Pike scythestone and axestone. For the lawn mower a Red Head Utility File. Then your wife won't take in the hammock and call you a bluffer.

Cherished Oilstones

The oldest remains of man in Egypt were recently dug up near Nineveh. Deposited in the graves were the most precious possessions to be used in heaven—hones, knives and scrapers. Let us have more heaven around home and in our modern work shops. You will cherish an India *Oilstone* and a Lily White Washita for years.

Sign the coupon below and read how experts sharpen various tools.

NORTON  **PIKE**
Use what Experts use
Sharpening Specialties

BEHR-MANNING CORP.
U. S. Sales Representatives
Dept. M., Troy, N. Y.

Please send me the Norton Pike book "How to Sharpen." I'm sharp enough to ask for it, since it's FREE.

Name.....

Address.....

My dealer is.....



Chines, inner chines, keel, transom, and stem must be faired and beveled to receive planking

HOW TO BUILD A RACING RUNABOUT

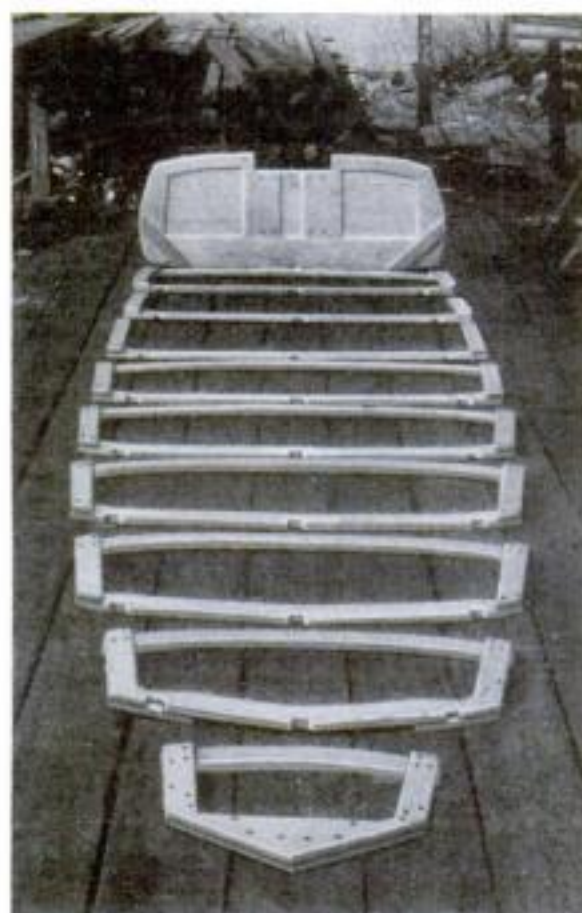
(Continued from page 61)

sized patterns on heavy paper such as wrapping paper. Take a sheet of wrapping paper the right size for one of the assembled frames and fold it in the middle. This fold will represent the center line. Next draw the water line at right angles to the fold. Then draw in the side and bottom frames according to the measurements given in the drawings. When this is done, punch holes through the paper at the proper points, unfold, and draw the other half.

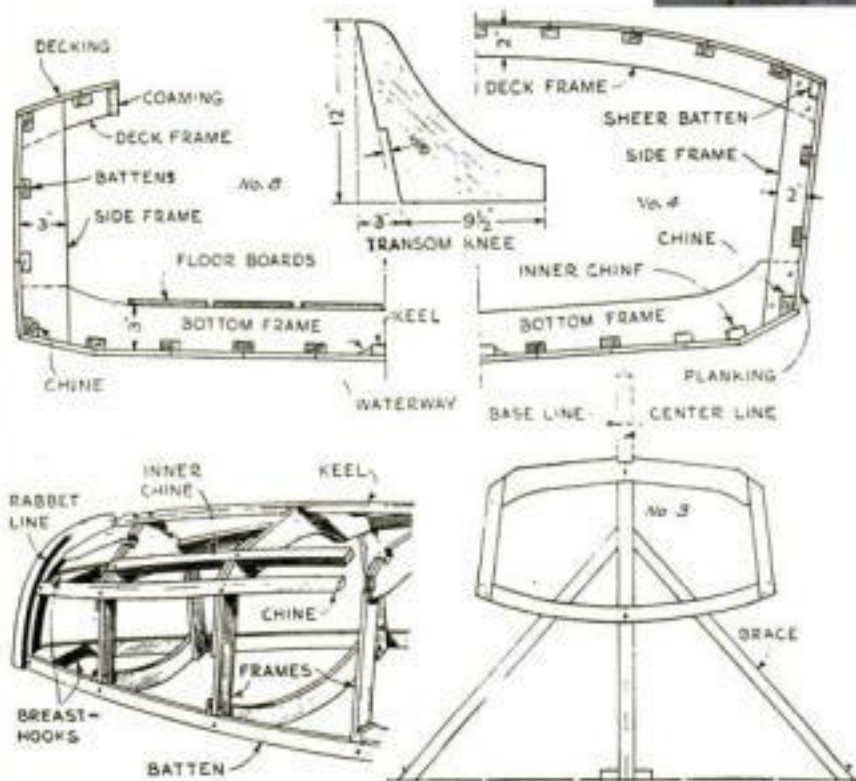
The patterns for the deck frames will have to be drawn with the aid of a compass, which is made by tying a long string to a pencil.

To lay out the frames from the patterns, place each pattern over the frame material and punch through with a marking wheel. The frames can then be sawn out and planed to shape. While the center and side frames are being fastened together, place them over the patterns; this will offer a final check. All bottom frames except No. 1 can be made in one piece, but corner pieces will be necessary at frame No. 2, as shown in the drawings. Bottom frame No. 1 and all side frames except Nos. 8, 9, and 10 can be cut from a straight 2-in. board. The notches for the keel may be cut in each frame at this time.

Fasten the frames together at each corner with two bolts, such as 1½-in. No. 10 machine



Transom and complete set of frames before being set up. Left: Additional drawings



screws, or with copper rivets. The bolts or rivets will have to be set in somewhat in the forward frame to allow for beveling. The transom frames and motor blocks should be cut out as shown in the drawings and screwed to the transom with 1-in. No. 8 screws. Coat the surfaces that are to be joined together with marine glue before fastening.

It will be necessary to draw a pattern for the stem, taking the measurements from the drawings. The stem should be cut from a piece of 1¼-in. (Continued on page 77)

NEW RACING RUNABOUT

(Continued from page 76)

oak and shaped as shown. Cut the rabbet to the correct depth for the thickness of the planking that will be used. Fasten the stem knee to the stem with several long screws.

Next set up the supports to which the frames will be fastened while the boat is being built. This framework is shown in the photographs, and the necessary measurements are given in one of the drawings. The essential part consists of an upright at each station to which the frame will be fastened. These uprights, of course, should be set up in perfect alignment, absolutely plumb. Brace them well at each side. (Continued on page 79)

List of Materials

Materials listed in order of preference

For	No. of Pieces	Size	Material
Planking	12	$\frac{3}{4}$ " x 8" x 14'	Philippine mahogany,
	4	$\frac{3}{8}$ " x 6" x 14'	white or red cedar, spruce, cypress, or white pine
Decking	10	$\frac{5}{16}$ " x 6" x 10'	Philippine mahogany, spruce, cedar, cypress, or white pine
Transom	1	$\frac{1}{2}$ " x 6" x 12'	Spruce, mahogany, white oak ($\frac{1}{2}$ " only), fir, maple, or yellow pine
Frames, transom frame, motor blocks, 2	6	$\frac{3}{4}$ " x 6" x 12'	Spruce, mahogany, white oak ($\frac{1}{2}$ " only), fir, maple, or yellow pine
coaming, deck beams, knees, etc.	2	$\frac{3}{4}$ " x 2" x 10'	Spruce, mahogany, fir, or yellow pine
Keel	1	$\frac{3}{4}$ " x 2" x 12'	White oak
or Chines	1	$\frac{3}{4}$ " x 1 $\frac{1}{2}$ " x 12'	Spruce, mahogany, fir, yellow pine, or cedar
	2	$\frac{3}{4}$ " x 1 $\frac{1}{4}$ " x 14'	White oak
or Inner chine	2	$\frac{3}{4}$ " x 1" x 14'	Spruce, mahogany, cedar, fir, or yellow pine
	2	$\frac{3}{4}$ " x 1 $\frac{1}{4}$ " x 12'	Spruce, mahogany, cedar, fir, or yellow pine
Battens	12	$\frac{5}{8}$ " x 1 $\frac{1}{4}$ " x 14'	Spruce, mahogany, cedar, fir, or yellow pine
Deck battens	9	$\frac{5}{8}$ " x 1 $\frac{1}{4}$ " x 10'	Spruce, mahogany, cedar, fir, or yellow pine
Stem, stem knee, transom knee, breast hooks	1	1 $\frac{1}{4}$ " x 8" x 4"	White oak, hackmatack (tamarack), mahogany, or maple
Fender and sheer molding or	3	$\frac{5}{8}$ " half-round, 14" long	Maple, oak, or ash
		40" of $\frac{3}{8}$ " or $\frac{1}{2}$ " half-oval	Aluminum or brass
Seat back	1	$\frac{3}{4}$ " x 1 $\frac{1}{2}$ " x 3'	Plywood

HARDWARE AND MISCELLANEOUS

Flathead brass or galvanized screws as follows: 17 gross $\frac{3}{8}$ " No. 6; 8 gross 1" No. 6; 2 gross 1 $\frac{1}{4}$ " No. 7; $\frac{1}{2}$ gross 1 $\frac{1}{2}$ " No. 8; and 2 doz. 2" No. 10. 1 gross 1 $\frac{1}{2}$ " No. 10 flathead brass or galvanized machine screws, and 1 gross No. 10 hexagon nuts. 3 doz. 1" No. 6 oval-head brass screws. 2—3" x $\frac{1}{4}$ " flathead galvanized stove bolts. 2 qt. marine glue (C quality). 4 $\frac{1}{2}$ yd. cotton flannelet. 1 qt. priming coat and 2 qt. marine enamel. 1 outboard bow plate. 1 outboard runabout-type steering wheel. 20 ft. $\frac{3}{4}$ " tiller cable. 4— $\frac{1}{4}$ " tiller-rope pulleys. 1 outboard fin, 6" x 12" or larger (aluminum).

CHANGES IN MATERIALS FOR 200-POUND CLASS-C RACER

Planking	$\frac{5}{16}$ "	Philippine mahogany
Decking	$\frac{3}{4}$ "	Philippine mahogany
Transom, frames, transom frame, coaming, deck beams, etc.	$\frac{1}{2}$ "	spruce
Keel	$\frac{3}{4}$ " x 1 $\frac{1}{2}$ "	spruce
Chines	$\frac{3}{4}$ " x 1 $\frac{1}{4}$ "	spruce
Inner chines	$\frac{3}{4}$ " x 1"	spruce
Battens	$\frac{1}{2}$ " x 1"	spruce
Deck battens	$\frac{1}{2}$ " x 1"	spruce

(Use $\frac{3}{4}$ " No. 6 screws in place of $\frac{7}{8}$ " No. 6 for fastening into battens.)

"What a surprise party I got for a dime!"



LYLE TALBOT . . . Warner Bros. Star, Union Leader smoker since 1924

MY FIRST pipeful of Union Leader tobacco gave me the surprise of my life. It cured me of the prejudice that expensive pipe mixtures are always best. You simply can't beat the

fragrant, mellow, full-flavored old Kentucky Burley in this grand old brand. And that dime-a-tin price adds a lot of profit to my pleasure. (It makes a grand cigarette, too.)

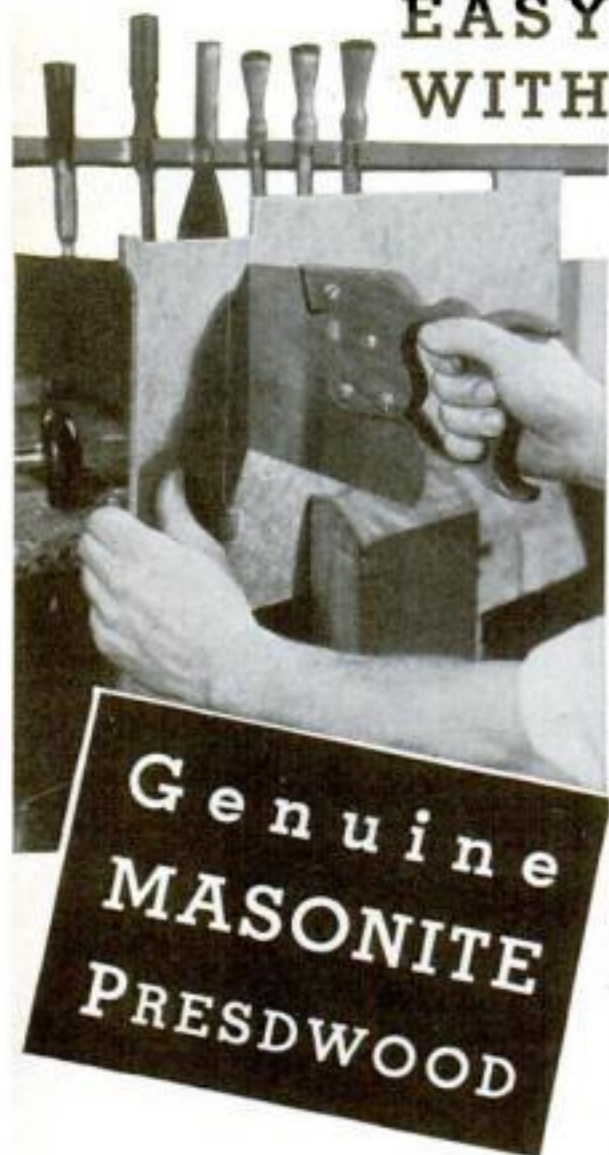
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UNION LEADER



THE GREAT AMERICAN SMOKE

MAKE YOUR "HOME-WORK" EASY WITH



**Genuine
MASONITE
PRESWOOD**

PRESWOOD is the ideal material for jobs around the house. It makes hard jobs easy, because it won't chip, crack or split. And when you do a job with PRESWOOD the job stays done, for PRESWOOD doesn't warp out of shape. You can finish it any way you want to or leave it unfinished. Its grainless, warm-brown surface will take any kind of paint or varnish, but it looks well without any.

And if your home-work is your hobby, you need PRESWOOD even more. Cabinet-workers and model-builders find many uses for it. Although it's strong, PRESWOOD won't dull your tools. It contains no glue or binder.

PRESWOOD is available in $\frac{1}{8}$ ", $\frac{3}{16}$ " and $\frac{1}{4}$ " boards at leading lumber dealers everywhere. The prices are very reasonable. Mail the coupon for a free sample of PRESWOOD and a booklet describing some of the many ways you can put it to work in your home.

MASONITE CORPORATION
111 W. Washington St., Chicago, Ill.

Please send me a free sample of Genuine Masonite PRESWOOD and a free descriptive booklet.

Name _____

Address _____

City _____ State _____

BLUEPRINTS

to aid you in your Home Workshop

TO HELP assure your success as an amateur craftsman, POPULAR SCIENCE MONTHLY offers blueprints for a number of well-tested projects. The following list gives a wide selection, but many other prints are available. Send a stamped and self-addressed envelope for a complete list.

Our blueprints are each 15 by 22 in. and cost 25 cents a sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means that there are two or more blueprints in the complete set. If the letter "R" follows a number, it indicates that the blueprint or set of blueprints is accompanied by photographically illustrated instructions which supplement the drawings. If you do not wish this supplement, omit the letter "R" from your order and deduct 25 cents from the price given. Instructions alone are 25 cents each.

FURNITURE

Bench and Tilt-top Table, Combination, 11	25
Cedar Chest, Mahogany Trimmed, 17	25
Chests, Treasure, 78	25
Child's Costumer, 179A	25
Coffee Table with Spiral Legs, 245A	25
Floor Lamp with Tripod Base, 243A	25
Magazine Rack, Ladder-Back Style, 250A	25
Mirror Frame with Split Turnings, 246A	25
Pier Cabinet and Hanging Shelves, 77	25
Lamps, Modern (no turning), 93	25
Sewing Cabinets, Two, 31	25
Silverware Chest on Stand, 256A	25
Smoking Cabinet (no turning), 2	25
Table, Four-Leaf Card, 239A	25
Table, Tavern, and Scroll Mirror, 105	25
Tea Wagon, 13	25

MISCELLANEOUS

Arbor with Garden Gate and Seats, 9	25
Automatic Lighthouse Night Lamp and Pelican Design Sewing Kit, 255A	25
Bird House, Log-Cabin, 244A	25
Doll's House, Colonial, 72	25
Doll's House Furniture, 73	25
Garden Chair, 260A	25
Log Cabin, Three-Room, 134-R	50
Microscope Kit, Portable, 220	25
Projector for Photos and Pictures, 259A	25
Six Simple Block Puzzles, 65	25
Star Chart, Perpetual, 214	25
Toy Birds and Animals, Jig-Sawed, 56	25
Toy Drill Press, Lathe, Saw, etc., 113	25
Toy Dump Truck, Fire Engine, etc., 101	25

RADIO SETS

All-Wave Portable (battery), 217-R	50
Amateur Short Wave Receiver, 155	25
Amateur Radio Transmitter, 183-184	50
Amplifier, Three-Stage Audio-Frequency, 42	25
Five-Tube Short Wave (A.C. or D.C.), 223	25
Full Electric Headphone Set, 130	25
One Tube (battery operated), 103	25
Screen-Grid Set, 109	25
Short-Wave Converter Unit, 137	25

SHIP AND COACH MODELS

(Construction kits are available for some of these models. See page 92.)	
Aircraft Carrier—U.S.S. Saratoga (18-in.) and flush deck destroyer (6 $\frac{1}{4}$ -in.), 226-227-R	75
Battleship—U. S. S. Texas (3-ft. hull), 197-198-199-200	1.00

NEW Racing Runabout

ORDINARY racing outboard motorboats are uncomfortable and not at all adapted for general use, but a new class of boat has been developed known as the "racing runabout." This is a stepless hydroplane designed for pleasure, yet suitable for racing under National Outboard Racing Commission rules. Our new Blueprints Nos. 261 and 262, price 50 cents, contain drawings for the latest and best type of 13-ft. racing runabout. Full-size patterns are available for \$1.50 additional.

Bottle, Clipper Ship in, 121-122	50
Civil War Ships Monitor, Merrimac, and Hartford (3 $\frac{1}{2}$, 5 $\frac{3}{4}$, and 5 $\frac{1}{2}$ in. long respectively), 258	25
Clipper Ship (20 $\frac{1}{2}$ -in. hull), 51-52-53-R	1.00
Clipper, Simplified (9 $\frac{1}{2}$ -in. hull), 219	25
Constitution (21-in. hull), 57-58-59-R	1.00
Cruiser Brooklyn (8-in.), 236	25
Cruiser Tuscaloosa (11 $\frac{3}{4}$ -in.), 234	25
Destroyer—U. S. S. Preston (31 $\frac{1}{2}$ -in. hull), 125-126-127-R	1.00
Galleon Revenge (25-in.), 206-207-208-209	1.00
Hartford, Farragut's Flagship (33 $\frac{1}{2}$ -in. hull), special prints 221-222-R	1.50
H. M. S. Bounty (8 $\frac{1}{2}$ -in. hull), 254	25
Mayflower (17 $\frac{1}{2}$ -in. hull), 83-84-85-R	1.00
Motorboat, 29-in. Cruiser, 63-64-R	75
Motorboat, Working Model (20-in.), 196	25
Liner—Aquitania (9-in.), 225	25
Liner—California (12 $\frac{1}{2}$ -in.), 251	25
Liner—Manhattan (12-in. long), 204	25
Liner—St. Louis (11-in.), 231	25
Privateer of 1812—Swallow, a Baltimore clipper (13-in. hull), 228-229-230-R	1.00
Santa Maria (18-in. hull), 74-75-76-R	1.00
Show Boat, Electrically Lighted (14-in.), 263	25
Stagecoach with horses, 144-145-146-R	1.00
Steamboat, Mississippi (19 $\frac{1}{2}$ -in.), 94-95-96-R	1.00
Steamships Savannah (3 in. over all) and Atlantic (6 in.), 235	25
Trading Schooner (17 $\frac{1}{2}$ -in. hull), 252-253	50
"Treasure Island" Ship Hispaniola (7-in.), 237	25
Viking Ship, (20 $\frac{1}{2}$ -in.), 61-62-R	75
Whaler—Wanderer (20 $\frac{1}{2}$ -in.), 151 to 154	1.00
Yacht Rainbow (7 $\frac{1}{2}$ -in. hull), 233	25
Yacht Sea Scout (42-in. racing), 106-107-R	75
Yacht, (20-in. racing), 48-R	50

FLYING AIRPLANE MODELS

Bremen (Junkers, 3-ft.), 89-90	50
Nieuport XVII, 29-in., 180-181	50
S. E. 5a World War Plane, 30-in., 168-169	50
Winnie Mae, 4-ft., 141-142-143	75

BOATS

*Canoe, 16-ft. Canvas Covered Kayak, with sail, etc., 192-193-194-R	1.00
*Duck Boat, Folding, 170-R	50
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257	25
*Outboard Racer, 10 $\frac{1}{2}$ -ft., 114 lb., 211-212-R	75
*Sailboat-Motorboat, Combination (15 ft., cat rig), 131-132-133-R	1.00
Marconi Rig with Jib for Above, 133-A	25
*15 $\frac{1}{2}$ -ft. Runabout or "Sportboat" (outboard or inboard motor), 175-176-177-R	1.00
*13-ft. Utility Rowboat (can be sailed or used with outboard motor), 224-R	50
*13-ft. Racing Runabout, 261-262	50

NOTE: Full-size patterns for any boat marked with an asterisk (*) will be drawn to order for \$1.50 extra. Simply add this amount to the cost of the blueprints. About one week is required to fill orders for patterns.

Popular Science Monthly
353 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows:

I am inclosing _____ dollars _____ cents

Name _____

Street _____

City and State _____

Please print your name and address clearly.



NEW RACING RUNABOUT

(Continued from page 77)

Mark the location of the base line on the uprights with some kind of straightedge, and measure down from the base line for the location of the stem and inner keel line. Then, in order to get a true keel line, clamp a light batten over the uprights. Cut off the uprights at the inside keel line. Draw a line down the center of each upright, and mark the exact center line of each bottom and deck frame.

Now the frames can be clamped or bolted into the correct position. The center line of each bottom and deck frame should correspond to the center line on the upright, and the keel notch should be flush with the top of the upright. The keel can next be set in place and screwed to each frame and to the stem knee with 2-in. No. 10 screws. After the keel is beveled forward, the stem can be fastened in position.

The transom should be secured to the keel with a large knee as shown in the drawings. Fasten the transom to the knee with several 2-in. No. 10 screws and at least one 1/4-in. bolt; follow the same procedure in fastening the keel to the knee.

The notches may now be cut for the chine and inner chine pieces. Before cutting the notches for the chine, clamp a light batten in place to make sure of getting a true curve and the proper bevels. It will be easiest to run the inner chine only as far as frame No. 1. The seam from this point to the stem may be made water-tight by putting in a small batten after the boat is turned right side up. Cut the chine pieces down to a thickness of about 1/4-in. at the points at which they are notched into the stem; deeper notches would weaken the stem. The same applies to such battens as are notched into the stem.

Screw the chines to the stem with 1 1/2-in. No. 8 screws and also to a breasthook fitted between the two chines at the stem, as shown. Bend back both chines at the same time, in order to avoid pulling the stem out of line. Clamp them in place and see that they are in a true curve; then fasten them to the frames with 1 1/2-in. No. 8 screws. Also be sure that all frames and the transom are at right angles to the keel. Do not cut any notches for chines or battens into the transom, but only into the transom frame.

Next bevel and fair the chines, inner chines, keel, transom, and stem so that the planking will fit perfectly. Before laying the planking, cut a waterway on either side of the keel as shown in the drawings.

Battens can be put in as the planking is fitted. Directions for planking and finishing the boat will be given in the July issue.

MATCHING COLORS IN PATCHING PLASTER

WHEN the plaster on painted walls cracks and needs mending with patching plaster, it is often a serious problem to match the original finish. The new strips of plaster may easily be colored with ordinary pastel crayons by touching the new surface lightly and rubbing down to the proper shade with a clean, dry cloth. This is much simpler than trying to match paint, which is almost impossible for any one to do successfully except an expert.

—CLEMENT B. RICKMAN.

BREATH TEST REVEALS WHEN LACQUER IS DRY

WHEN more than one coat of lacquer is to be applied to any article, each coat should be perfectly dry before the next is added. A simple way to learn whether or not a coat of lacquer is bone dry is to breathe on it. If it is not entirely dry, the breath will cause the surface to fog over temporarily.—O. B.

"I'D RATHER FACE A THOUSAND SPIKES THAN ANOTHER BLOW-OUT"

says MICKEY COCHRANE, Manager of the Detroit Tigers



You need this new life-saving tire now!

"I've had plenty of close shaves behind the plate," says MICKEY COCHRANE, "but the scares I've had were tame compared to what I went through when I had a blow-out. My car was traveling about 45 miles per hour when blow-out occurred. I grabbed at the wheel with all my might, but it was no use. The car dove right off the road. Trees, poles and fences were straight ahead. I don't understand now what kept my car from turning over. That's why you'll see me driving on Goodrich Silvertowns."

Here's why *your* car should be equipped with Goodrich Safety Silvertowns. Smaller wheels that speed faster than ever generate blistering heat *inside* the tire. Unless that internal heat is resisted, the rubber, slowly but surely, pulls away from the fabric. Then what happens? A blister forms which, unknown to you, grows bigger and bigger—until BANG! The tire rips wide open! A blow-out! And altogether too often, human lives are snuffed out—people are injured—cars are wrecked.

A secret compound

Built into every new Goodrich Silvertown—and *only* in Silvertowns—is the remarkable Life-Saver Golden Ply. This specially treated compound resists heat—keeps rubber and fabric from pulling apart. That's why this blow-out that might have come simply never gets a start.

But that's not all. Go to your Goodrich dealer. Press the palm of your hand down hard on the sure-footed, deep-grooved Silvertown tread. Feel those big, husky cleats grip. Then you'll realize why Goodrich Silvertowns give you such positive protection against dangerous side-slipping "tailspins."

For safety's sake—for months of extra mileage—put these new Goodrich Silvertowns with the Life-Saver Golden Ply on all four wheels—quick! Remember, Silvertowns cost not a penny more than other standard tires.

Copyright, 1935, The B. F. Goodrich Co.

HEAT CAUSES BLOW-OUTS—THE LIFE-SAVER GOLDEN PLY RESISTS HEAT—PREVENTS THESE BLOW-OUTS

DON'T MISS THIS RADIO TREAT

Circus Night in Silvertown

starring **JOE COOK**

with **B. A. ROLFE** and others

EVERY FRIDAY NIGHT N. B. C. BLUE NETWORK

The **Goodrich Safety Silvertown** WITH LIFE-SAVER GOLDEN PLY

Here's something new in Color Schemes



★ Right in your community there's a man who can show you something new and different about color schemes for your home. He is the dealer who sells Lowe Brothers Paints. And what he has to show you is this: a "Pictorial Color Chart" with full color illustrations—all painted with actual paint.

You can see which colors produce the most pleasing effects on various types of homes and in every kind of room. You can see how one color "goes" with another—you can be assured of perfect results before a single stroke of painting is done.

And you can select your colors knowing that those you choose are the colors you will get. There is a Lowe Brothers Paint, Varnish, Enamel or Stain to give you the exact shade you see in each of the many different color schemes. And Lowe Brothers Paints insure a job that looks better longer. They are 90% film-forming solids—solids that remain on the surface. In contrast, many "cheap" paints contain as much as 63% water and other evaporating liquids.

Ask your dealer to show you the Lowe Brothers "Pictorial Color Chart" today. The Lowe Brothers Co., Dayton, Ohio.

Lowe Brothers
PAINTS • VARNISHES
QUALITY UNSURPASSED SINCE 1869

Ornamental Handles

BUILT UP FROM THIN CELLULOID

By Kenneth Murray



Celluloid, added layer by layer and trimmed with a razor blade, formed the handle above

ATTRACTIVE handles for such commonly used articles as nail files, pocketknives, combs, and razors can be made by cementing together pieces of sheet celluloid. By means of a simple chemical treatment, the celluloid can be colored any hue, and dipping the handles in a special varnish renders the surface practically fireproof. As in the case of the cuff links, tie clasp, and key tag previously described (P. S. M., May '35, p. 112), each handle may be given a personal touch by adding a name or monogram.

Before making a new knife handle, it is necessary to remove the old handle and roughen the brass casing with a coarse file. Coat the surface with celluloid cement (celluloid scraps dissolved in acetone). When this is dry, flow acetone on strips of celluloid with an eye dropper and press them into place, one after another, until a sufficient thickness has been built up. When this is dry, you can trim the edges with a razor blade and file the edges to the desired shape. Restore the glossy finish by flowing on more acetone.



Acetone can be made to dry more slowly by adding five drops of amyl acetate (the familiar "banana oil") to each ounce.

Nail-file handles may be built up in the same manner. The application of some gold or silver bronze powder between the sheets of celluloid will give it the appearance of "fools' gold" stone. The acetone will cause the bronze to flow over the surface, and it can be further spread by kneading the built-up layers between the fingers. Thick handles require only a light dusting of bronze between the layers.

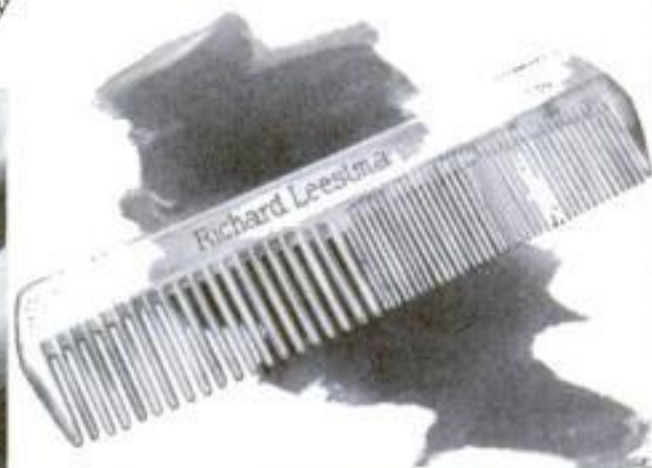


The nail file shown above has a built-on celluloid handle. Left, how bronze powder can be dusted between the layers



A ten-cent pocket comb is made stronger and improved in appearance by adding strips to the back. The regular back is squared up and the sides are cut down with a coarse file. You can then attach the desired number of strips of celluloid.

If you can do neat lettering, names and monograms can be added to the handles with a fine pen and India ink, instead of using pieces of photographic film with the names printed on them as described last month. Different colored dyes dissolved in either acetone, ether, or alcohol can also be used for ink. A piece of



This comb has an ornamental back which adds strength. The photo at left shows the process

clear celluloid should always be welded over the lettering, for a protective covering.

Coloring the sheet celluloid, or the outside surface of completed celluloid articles, is not difficult. First clean the material thoroughly, as a trace of oil, or even finger prints, will spoil the result. For a black color, soak the celluloid in a saturated solution of silver nitrate for an hour, and dry in bright sunlight. For red, clean



A piece of photographic negative, with name printed on it, being applied to a toothbrush

the celluloid with dilute nitric acid, then soak in a solution of aniline red dye which has been made alkaline with the addition of an ounce of ammonia to each five ounces of solution. Other aniline dyes may be used in the same manner. A strong potassium bichromate solution will color the celluloid yellow or orange, according to how long it is allowed to act; a brown can be obtained with a potassium permanganate solution, with a pinch of baking soda added to each ounce to increase the color.

A celluloid varnish that is practically fire-proof can be applied to



The completed tooth brush, bearing the author's name

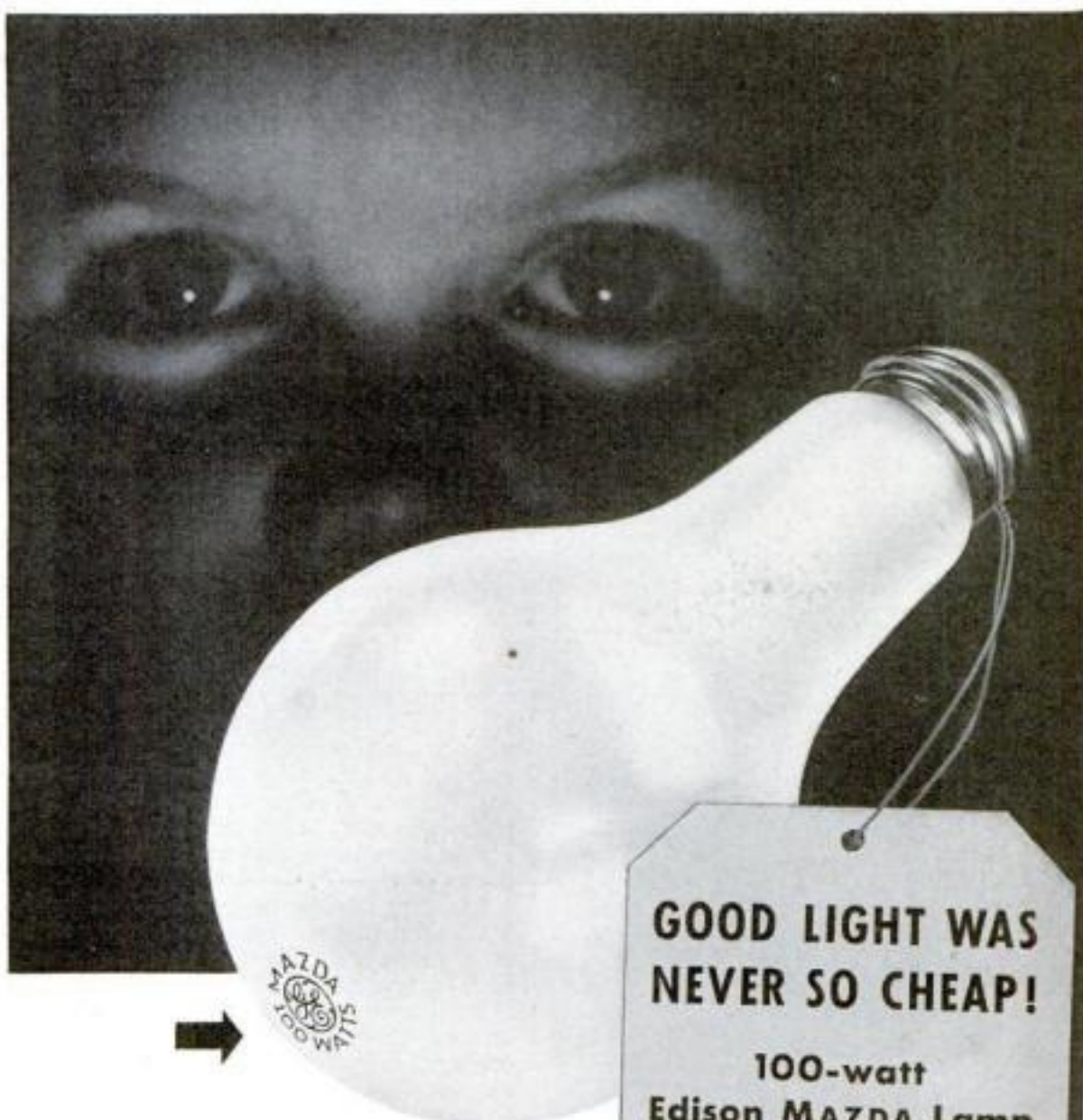
any article without impairing or changing its appearance. To make the varnish, mix an ounce, each of ether and methylated alcohol (not common radiator alcohol) and dissolve enough celluloid scraps in it to give a very thick, molasses-like syrup. To this is added another ounce of equal parts of ether and alcohol, in which dissolve as much perchloride of iron as possible. The varnish will have a yellowish appearance; however, this color is not noticeable when the varnish is applied.

HOW TO FASTEN NAILS FIRMLY IN PLASTER

WATER glass—the silicates of sodium or potassium, or of both—can be used successfully to make nails stand firmly in a plaster wall. There are two occasions on which it can be applied: when new holes are to be driven into the plaster, and when you must find a new way to make nails stick in holes that already have been driven—from which the plaster is beginning to crumble away. First, drive the nail into the wall, then remove it, and fill the hole with water glass. Replace the nail immediately; you will find that very soon it has become firmly fixed in its place. In the second situation, wrap the nails in cotton, soak the cotton in water glass, and then restore them to their holes.—E. V. B.

Precious EYES

NO NEED TO STRAIN THEM NOW!



GOOD LIGHT WAS NEVER SO CHEAP!

100-watt
Edison MAZDA Lamp
WAS ~~25c~~

now only **20c**

New low prices on other popular sizes

15-25-40-60-watt
were ~~20c~~ NOW **15c**

150-watt • was 50c • NOW 35c


200-watt • was 70c • NOW 55c

300-watt • was \$1.15 • NOW 90c

HERE is good news for parents! The 100-watt Edison MAZDA lamp...so fine for reading or sewing without eye-strain...now costs only 20¢. Which means that no pair of eyes need suffer for lack of adequate light.

You need this sight-saving size in many places. Your single-socket reading lamps, kitchen ceiling fixture, laundry, all call for at least 100 watts.

Keep a fresh supply on hand. Avoid "borrowing" from other sockets or falling back on smaller lamps that are less kind to your eyes.

One word of warning: Avoid early burn-outs or wasted electricity by always looking for this mark . More than ever it means good light at low cost.

EDISON MAZDA LAMPS

GENERAL  ELECTRIC

NICHOLSON
U.S.A.
MADE IN U.S.A.



The
HANDY MAN
BECOMES
A
CRAFTSMAN

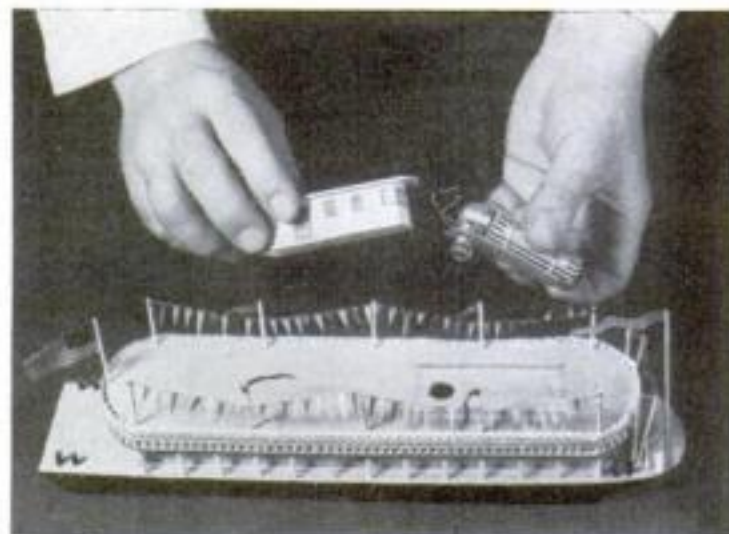
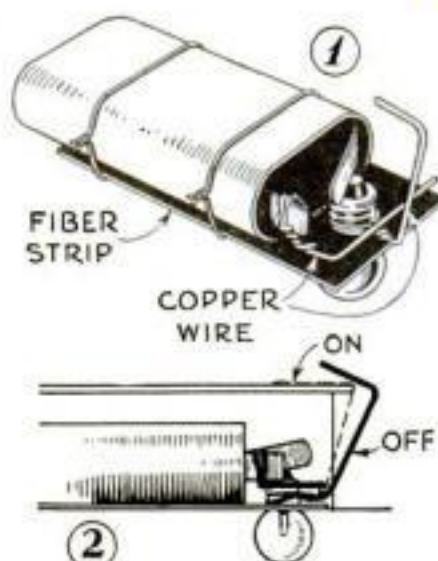
No longer is the handy man a mere whittler who kills time doing odd jobs. He is a finished craftsman making things of practical value for use in and around his home.

More than any other tool, he uses Nicholson Files. He uses them because they can do such a high percentage of his jobs. He chooses them because they are sharp, durable, dependable; because they come in shapes and sizes for every demand. Popular prices at hardware stores everywhere. Nicholson File Company, Providence, R. I., U. S. A.

Genuine
NICHOLSON FILES
A FILE FOR EVERY PURPOSE

MINIATURE SHOW BOAT WITH LIGHTS

(Continued from page 65)



The photograph shows the removable lighting unit, which is hidden under the upper deck house. Sketch No. 1 is the battery, bulb, and improvised switch, and sketch No. 2 shows them in place.

glue to block F . Glue G^2 on other side with its front edge meeting G^1 . Where G^1 and G^2 overlap at back, cut through middle of joint with razor blade and remove waste. Bottom edge of each strip can be sandpapered if necessary to fit sheer of hull. It is easier to paint cardboard before gluing in place. Windows and doors can be trimmed with mahogany-brown edges. Windows not cut out may be streaked with light blue to represent glass, and sash bars painted on. To stiffen center portion of G^1 and G^2 , set several posts into hull on inside, or use blocks.

Drive six pins, without heads, into sides of blocks E and F where shown by dots, to support B . Cut out center of B to fit over E and F and, of course, also over cardboard sidepieces G^1 and G^2 .

Cut twenty-six square posts $3/32$ by $3/32$ by $15/8$ in. Shave off corners slightly at both ends. From underside of B press upper end of each post through holes in both B and C . Separate B and C slightly on posts to hold them straight. Then press lower ends of posts into corresponding holes in hull. Work B down over cardboard sides G to rest on pins. Push C down to rest on E and F after applying glue. See that B and C follow curve or sheer of hull, dipping $1/8$ in. in middle. When glue is dry, snip off projecting ends of posts.

Rails. From paper doilies of the imitation lace variety, cut strips of suitable fretwork design to glue on edges of B and C as shown. Lay the paper face down and apply thin glue to the whole; then fasten it with its lower edge even with B and its top edge projecting about $3/16$ in. above C to form the top-deck railing. Press in position with a flat piece of wood. Overlap the joints and patch any broken places. Two rails of thread are glued as shown to posts below, the upper one being $1/4$ in. above the hull block. Paint posts, paper

strips, and threads white. A red stripe may be painted along bottom of paper strips, or any desired colors or decorations added.

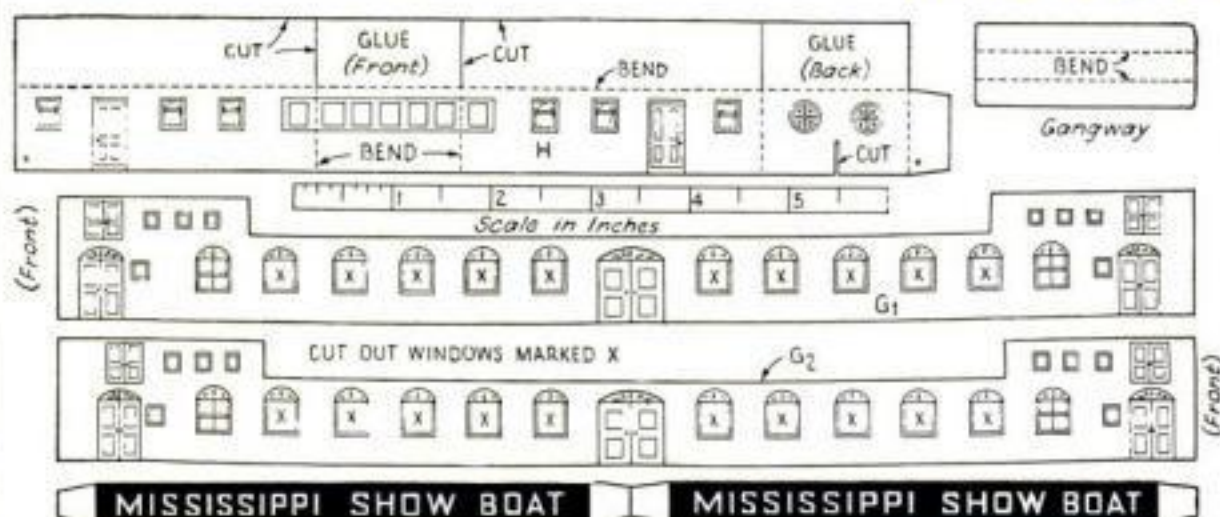
Flagstaffs and Fittings. Add one long flagpole aft, passing through B and C into A , and extending $3 1/8$ in. above A . Insert five smaller flagpoles on each side, passing through C and just entering holes in B . They should project $1 5/16$ in. above C . Place large flagpole at bow (extending $3 1/2$ in. above A) and two gangway derricks where shown to support a cardboard gangplank $2 1/4$ in. long. Bridle and cords for gangplank are one piece of thin wire of a length to allow it to be glued to deck. All these parts are white.

Set eight $3/32$ - or $1/8$ -in. square posts into decks where shown, projecting $1/4$ in., and paint black. These are the bitts for tow ropes.

The four ladders are solid strips of wood cut on angle at each end. The spaces between the steps are marked with black pencil as if they were open. Ladders are then varnished.

Upper Deck House. Make this "Texas," as it is called, from cardboard as shown at H , with wood roof D , which can be cut from the waste remaining from B . The house is removable; it merely fits over two battens on deck C . Paint white with brown trim, streak windows with blue, and add red curtains where indicated.

Illumination. Obtain small flash-light battery and suitable bulb. Bore hole in C where indicated, slightly larger than bulb. In piece of fiber 1 by $2 1/2$ in., bore hole a tight fit for threads of bulb, and screw bulb in. Fasten fiber with wire to battery so one terminal lug of battery presses against center contact of bulb. Bend end of the other terminal lug and fasten bare copper wire to it as shown (see sketches). Twist end of another copper wire around threads of bulb. Bend the wire from side terminal of (Continued on page 83)



How to lay out the cardboard parts. Dimensions can be found by referring to the scale of inches.

MINIATURE SHOW BOAT

(Continued from page 82)

battery to go horizontally across the Texas just inside the after end. Let the end of the wire project out through a hole on the opposite side of the Texas to hold it horizontal. Bring the other wire straight out underneath through a slot in the after wall of the Texas. Set the Texas and battery in place on C; then bend the projecting wire as shown so that pulling it up will switch on the light. Pressing the bent end of this wire over the Texas roof will hold this improvised switch in the "on" position. A scrap of colored transparent wrapping material can be pressed in the hole in C before setting the bulb in place to give any color desired.

Flags. American ensign at stern; others of colored paper. To make each string of flags, stretch thread between two pins in a board with waxed paper underneath; touch edges of flags with glue, and press down.

Name Plates. Two cardboard strips $\frac{1}{2}$ by 5 in. can be painted with desired name and fastened to the top deck like signs, or the name can be painted directly on the Texas.

List of Materials

No. of Pieces	T.	W.	L.	Material
1	$\frac{3}{4}$	3	14	Balsa for A
2	$\frac{1}{16}$	3	$11\frac{1}{4}$	" " B, C, D
2	$\frac{1}{4}$	1	$1\frac{1}{8}$	" " E, F
	$\frac{3}{32}$ or $\frac{1}{8}$ square		59	Pine or balsa for posts, battens, and bits
4	$\frac{3}{32}$	$\frac{1}{4}$	1	Pine or balsa for ladders
	$\frac{3}{32}$ or $\frac{1}{8}$ round		9	Pine or hardwood for flagpole and derricks
	$\frac{1}{16}$ round		25	Pine or hardwood for derricks and flagpoles

MISCELLANEOUS

3-ply Bristol board or cardboard 6 by 13 in. for G¹, G², H, gangplank, and signs. Strips of edging from paper doilies $11\frac{1}{16}$ by 28 in. for sides. 2 pc. No. 24 copper wire 3 in. long for gangways. 6 pins to support deck B.

Black, white, red, and brown paint; buff paint or varnish for decks. (Brown and white paint may be mixed to give buff.)

1 small American ensign and scraps of colored paper for streamers.

Glue (casein preferred) and sandpaper.

Lighting outfit: 1 small, flat flash-light battery and lamp; 1 pc. fiber $\frac{1}{16}$ in. or less thick by 1 by $2\frac{1}{2}$ in., or a 1 by $2\frac{1}{4}$ in. pc. of tough, heavy cardboard; 12 in. of No. 24 copper wire.

NOTE: Pine may be substituted for balsa for parts A, B, C, D, E, and F. All dimensions are given in inches.

USING PRINTED LETTERS FOR NAMES ON MODELS

WISHING to simplify the job of printing names on model boats and have them in proper proportion to the size of the model, I hit upon the idea of looking through the advertisements in POPULAR SCIENCE MONTHLY for letters of suitable size and style. I have always been able to obtain a sufficient quantity of letters to make any name required. When the name was to be in white on a black background, I used white characters surrounded by black. In such cases it is unnecessary to trim out the letter completely, as the black ink will blend with the black background and become invisible. Such letters can be found in various sizes from $\frac{1}{16}$ in. up.

As an example, I am using the advertisement of a large arms company to get letters to put on a miniature model of the *Sea Witch*. The part of the advertisement used is that reading: "Send 3¢ stamp with this coupon." These white letters look very well on the black bulwarks of the *Sea Witch*, and it is much more simple to stick them on than to try painting them.—HARRY J. WALSH.

NO WAY TO ESCAPE THOSE ACCUSING EYES



...I was never so embarrassed in my life!

"I'D RATHER take a beating than appear in public again with a growth of stubble on my face," confesses a man who tried to skip shaving and get by.

Why should any man risk the respect of others by failing to keep clean-shaven! Today comfort and satisfaction are *positively guaranteed* when you shave with the Gillette "Blue Blade." We know beyond a shadow of a doubt that no better blade can be produced. It is the product of manufacturing facilities and skill unequalled the world over. Relentless inspection begins with the steel when it arrives from the mill. Every reel must answer Gillette specifications—the most rigid known. For absolute uniformity and perfection of tem-

per the steel is fed through electrically controlled furnaces exclusive with Gillette. Temperature changes in accordance with the requirements of the metal—assuring correct hardness for super-keen edges that stand up. Grinding, honing and stropping are automatic—almost unbelievably accurate.

Inspection is uncompromising. No faulty blade can pass. And—to protect its perfectly finished edges—each blade is firmly anchored in its envelope at four points. It reaches you as keen as it left the factory. Get the benefit of unmatched manufacturing care and skill. For unusual comfort try the Gillette "Blue Blade" tomorrow morning.

Reputable merchants give you what you ask for. In stores where substitution is practised—INSIST ON

GILLETTE BLUE BLADES

NOW 5 for 25¢ • 10 for 49¢



A TWIST... IT'S OPEN!

The ARISTOCRAT —New Gillette One Piece Razor

The Aristocrat is all one piece, no loose parts. Heavily plated with 24-Karat gold and guaranteed a lifetime. Price \$4 complete in smart leather case with 10 Gillette "Blue Blades."



A TWIST... IT'S CLOSED!



"I can remember buying it for Dad when I was 10 years old"

Writes
William Baker Edmonston
of Winthrop, Massachusetts

"Now, along with my Dad's characteristics, features and peculiarities, I inherit his pleasures, and among them is **EDGEWORTH** tobacco."

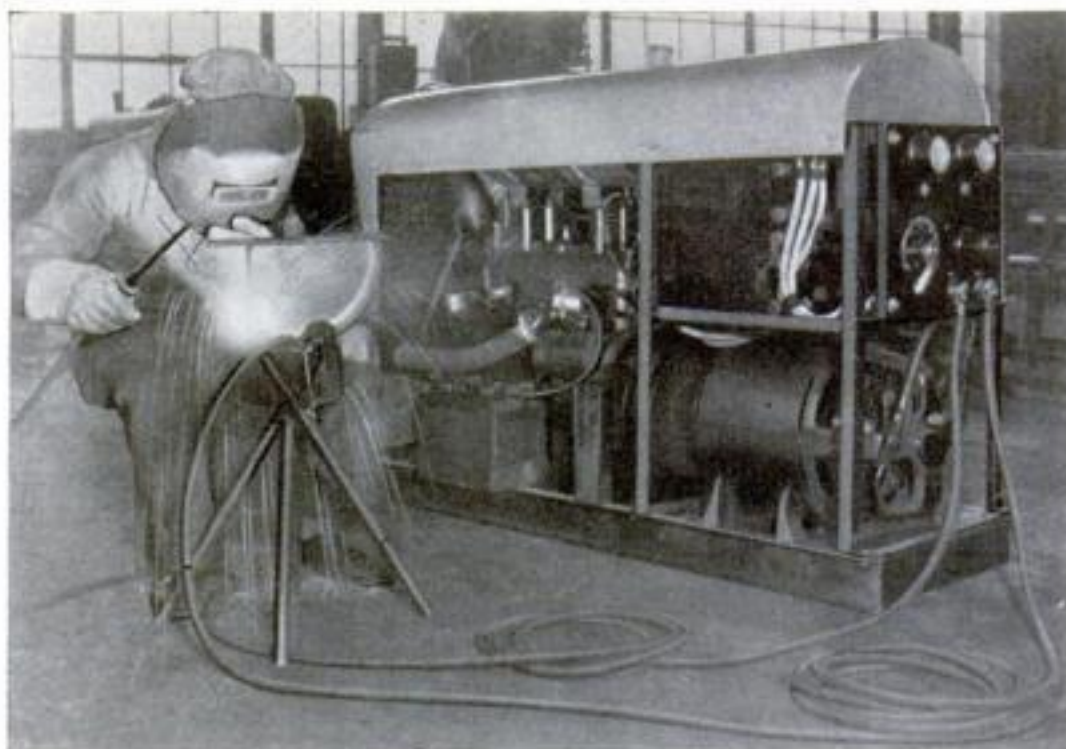


Mr. Edmonston's letter continues:

"It wasn't really a liking for tobacco that I inherited. It was just plain good judgment."

MILLIONS of smokers share your good judgment, Mr. Edmonston. We publish letters from satisfied Edgeworth smokers in this magazine from time to time so that other lovers of true tobacco flavor and real pipe mildness will discover the tobacco that combines those two qualities perfectly—Edgeworth. The world is getting to be a better place to live in all the time.

Larus & Brother Co., Richmond, Virginia. Tobacconists since 1877. On your radio, tune in on WRVA, the Edgeworth Tobacco Station, 1110 Kilocycles.



SHOP-BUILT Arc Welder

Run by Old Auto Engine

By
HAROLD P. STRAND



The motor in place. On the floor is a large fiber disk to fit the flywheel, with a steel hub for the generator shaft

frame are 4-in. channel iron, as are the generator cross supports. The motor supports are 3-in. channel with a specially formed, arch-shaped front member and two upright rear hangers. A crosspiece is placed in the center of the frame to make it rigid.

The motor used in the welder illustrated is a model-A Ford. It has a removable cover on the timing-gear case, and several manufacturers supply a governor that is bolted on in place of the cover. The problem of speed control is thus easily solved.

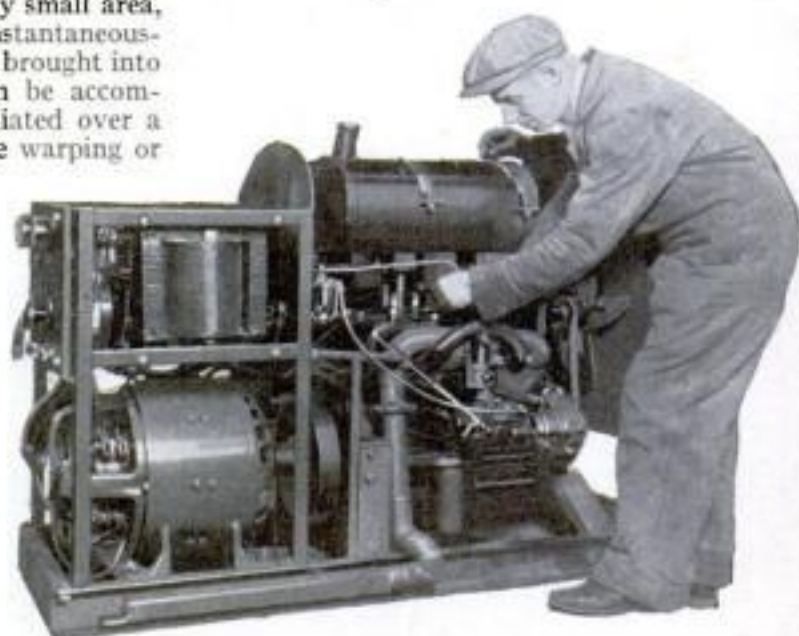
NO ITEM of shop equipment is better appreciated than a good arc welding outfit. One can be constructed in the shop that will render excellent service, yet will cost much less than a commercially built welder.

Electric welding has a decided advantage in that the heat is confined to a very small area, the welding being accomplished instantaneously. The metal does not have to be brought into a molten state before fusion can be accomplished, thus the heat is not radiated over a comparatively large area to cause warping or other damage.

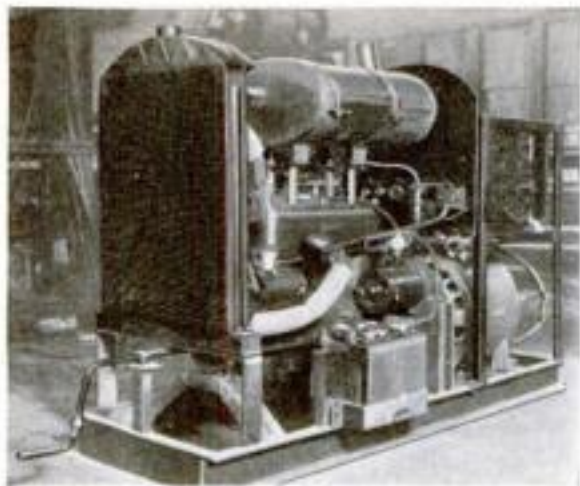
Do not make the mistake of thinking that any old generator may be used for electric welding purposes. The machine must have a capacity of at least 200 amperes at from 25 to 40 volts. This eliminates most lighting and similar type generators. On the other hand, an electroplating generator will often serve very well. If a generator that will meet the above requirements is not at hand, it would be wise to purchase one, along with the necessary electrical controls, from a house dealing in welding equipment.

The side members of the

It will be necessary to borrow an electric welder in order to assemble the parts in a strong manner. Bolting the parts is not recommended. When the frame and its supports have been partly tacked in place by the necessary welding spots, the motor is set up to check the alignment. The front of the motor



The welder complete except for the hood, which is shown in the photo at top of page. Note how exhaust pipe is extended



How radiator, tank, and battery are mounted. The tank is a junked one, cut down in length

requires that two pieces of $\frac{7}{8}$ -in. steel tubing, with a $\frac{3}{16}$ -in. wall and $\frac{7}{8}$ in. long, be welded on top of the arched support to steady the motor. These pieces fit over the motor bolts and seat at the shoulder of the Y-shaped regular motor bracket.

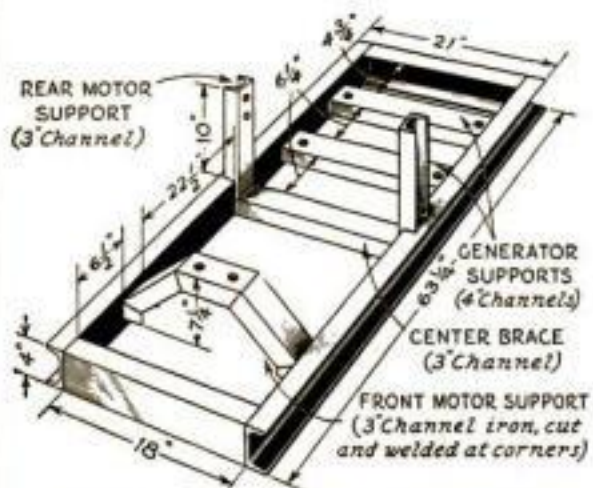
A flexible coupling is used between the motor and generator to absorb vibration and correct any small errors in alignment. The large disk is made of a fibrous nonmetallic material. Eight holes must be drilled and tapped in the face of the flywheel to receive the cap screws. These must be very accurately laid out. The steel hub fits the generator shaft and is secured with a set screw and a key.

To insure as nearly perfect alignment between motor and generator as possible, a special jig was made, as shown in one of the photos. The generator is shimmed up or moved to right or left until the pointed screws make perfect contact around their circles. The holes for the generator bolts can then be marked with a sharp instrument through the holes.

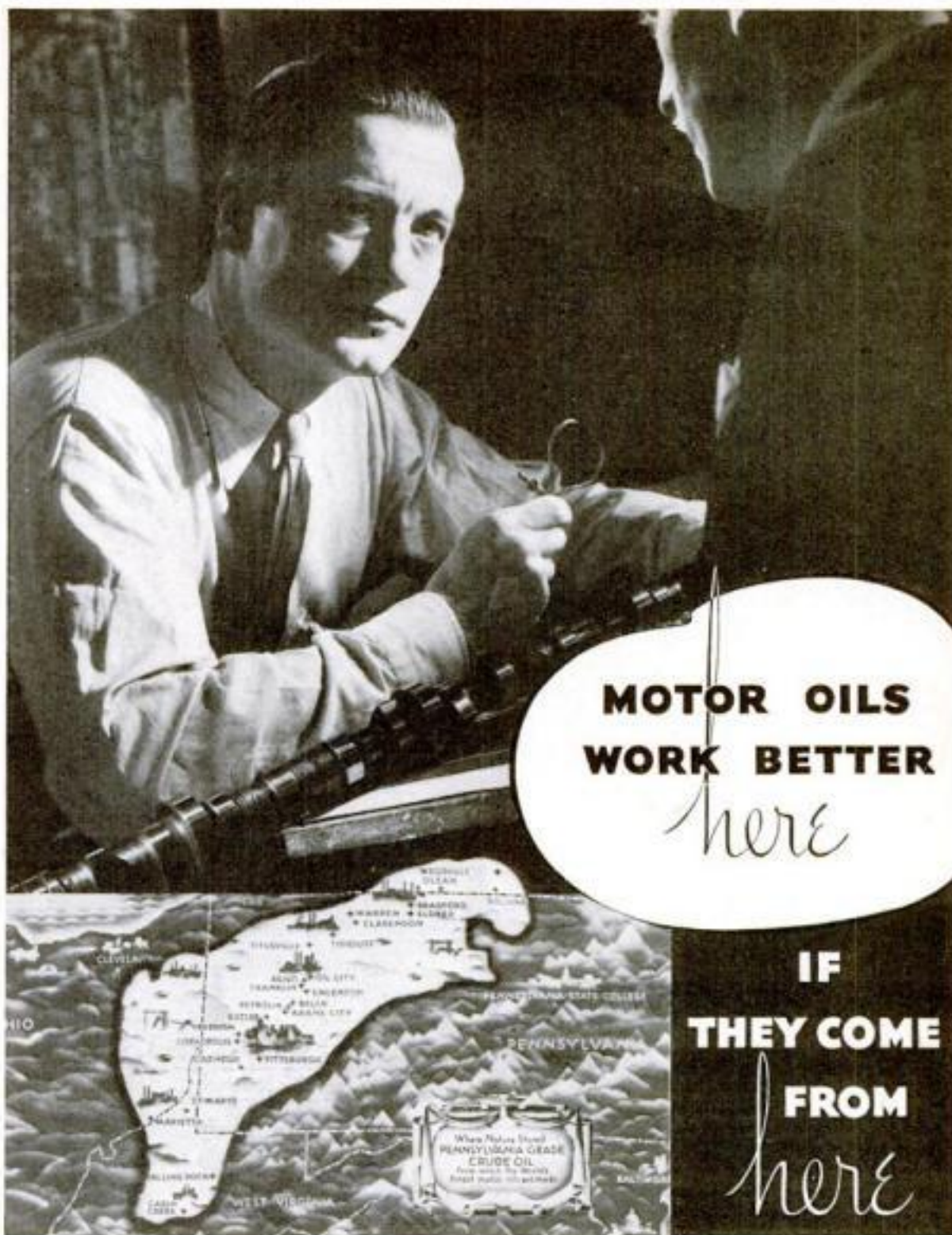
The electrical control unit consists of a panel with ammeter, voltmeter, field rheostat, current selector switch, and terminal posts, and also contains a reactance coil, resistance unit, and various wires and terminals. This complete unit is purchased all assembled and wired in its angle-iron frame. The dimensions of this frame are such as to fit the dimensions of the welder frame as given in the drawing.

The exhaust pipe is carried along the frame by making elbows of steel tubing with welded joints. The tank was obtained in a junk yard and cut down somewhat in length. The radiator supports are made from $2\frac{1}{4}$ -in. flat stock. A support for the starting crank is also built up on the frame. The radiator is mounted on a block of wood.

A close-up photo of the motor shows the governor, carburetor, and steel panel installed in back of the motor for the instruments. It has the usual ammeter and ignition switch, and also a button for operating the magnetic starting switch. A support for the carburetor adjusting rod can be seen, and also a sediment bulb. Note the method of connecting governor to carburetor. (Continued on page 98)



The frame is built of 3- and 4-in. channels, which should be welded, not bolted, together



THE CAMSHAFT shown in the picture is one vital part of your motor where motor oils must work well. Here, as in dozens of other vital spots, Pennsylvania motor oils guard against heat, friction, wear. They prevent internal injury, make your engine sweeter and more powerful.

Why is this true? The map tells the story. The area shown here is the one place where Nature stored her richest lubricant—Pennsylvania Grade Crude oil. From this specially favored crude are refined all the motor oils which are sold under the insignia of the Pennsylvania Grade Crude Oil Association. They are better oils from the ground up.

This year oil advertisements are buzzing with new claims, new processes, "new" oils. Enough to bewilder an expert! Almost all motor oils, including Pennsylvania oils, share the benefits of improved refining. But no oils except the Pennsylvania oils share the advantages Nature put into Pennsylvania Grade Crude! Pennsylvania motor oils are still first in quality and performance!

Now, as always — to get the best your car can give—buy an emblem-protected Pennsylvania motor oil!

Pennsylvania Grade Crude Oil Association, Oil City, Pennsylvania.

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What This Emblem Means!

This emblem is the badge of membership in the Pennsylvania Grade Crude Oil Association. It is neither a brand, nor a pledge of equal quality among the brands using it.

You are protected when you buy oils sold under this emblem, because it assures you that (a) they are made 100% from Pennsylvania Grade Crude, and (b) they meet or exceed the high minimum standards set by the Association to assure proper lubrication of modern motors.

Safeguarding these assurances are: (1) the research laboratory of the Association at State College, Pa., (2) a national field force, and (3) each member's individual surety bond.

BETTER OILS FROM THE GROUND UP!

INSIST ON THE

Genuine



PLASTIC WOOD

for PERMANENT REPAIRS

**HANDLES LIKE PUTTY
DRIES TO HARD WOOD**

Genuine Plastic Wood is actual wood that comes in cans and tubes—can be moulded with the hands—when dry it is hard, permanent wood that can be sawed, planed, sanded, drilled, turned on a lathe—will hold nails and screws without splitting, cracking or crumbling—can be painted, varnished and lacquered perfectly—it is water-proof and weather-proof.

Plastic Wood will adhere to any clean, dry surface—wood, metal, glass, stone. Comes in nine different colors: Natural, Oak, Walnut, Light Mahogany, Dark Mahogany, Cedar, White, Gum and Ebony.

Remember there is only one genuine Plastic Wood—do not confuse it with cheap mineral fillers.

1001 Uses for Plastic Wood

Repair damaged furniture, loose drawer pulls, loose casters, drainboard cracks; damaged toilet seats, loose bathroom fixtures, around pipe holes, cracks in shelving; cover countersunk screws, leaky window frames, shingled roofs; fill old screw holes, repairing linoleum, filling floor cracks, replace wood rot, fill holes after wiring, patching automobile tops, stop windshield leaks, boat and canoe repairs; loose tiles, baseboard cracks, cracks in stucco, cement; cracked porcelain, cabinet making, pattern making.

Get your can or tube of genuine Plastic Wood (made by the A. S. Boyle Co. Inc., Cincinnati, Ohio) at all leading hardware, paint, department stores.

PLASTIC WOOD

TWO *Attractive Seats*

FOR THE
FAMILY CIRCLE



By
**Herman
Hjorth**

AT FAMILY gatherings, whether on the porch in summer or around the fireplace in colder seasons, it is often desirable to have a seat for the younger folks that does not take up very much room. Two decorative stools for this purpose are illustrated, one with a wooden and the other with a metal frame.

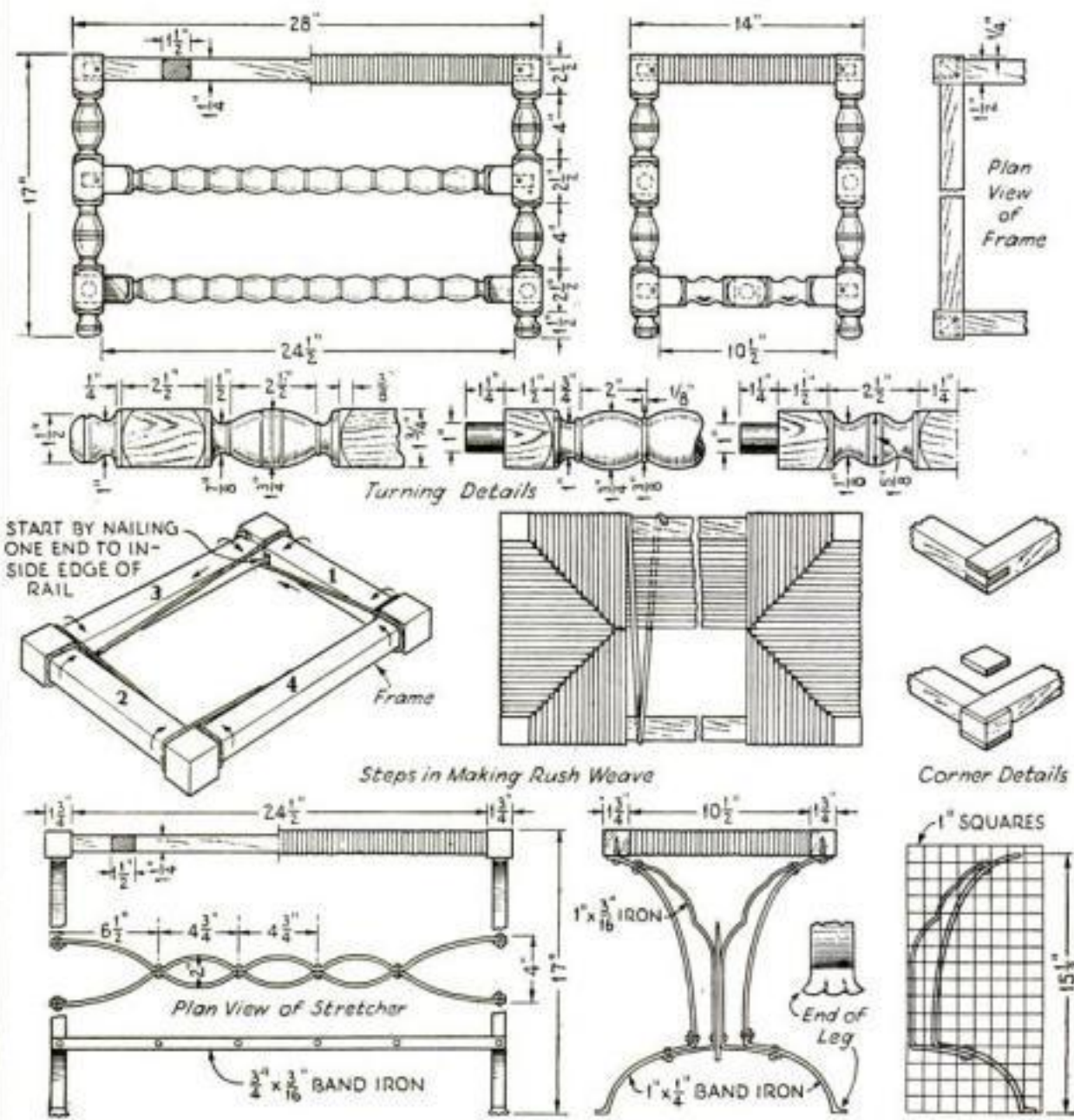
The all-wood stool is designed in the style of the Renaissance period. Begin by making full-size drawings of the turned legs and

stretchers. Any good cabinet wood will serve, but to be true to the period, either oak or walnut should be used. The rails on which the seat weaving is done should be made of strong, straight-grained lumber. These are mortised into the legs. The ends of the tenons should be mitered at 45 deg. as shown in the plan view.

The two ends are now fitted and glued together. When dry, the joined parts are smoothed and pegged.

The three long stretchers and two rails are then glued to the ends. After the clamps are removed, the joints are smoothed and pegged. It is better to finish the woodwork before weaving the seat; use a coat of stain followed by three or four coats of thin shellac.

The sharp edges of the rails should be rounded slightly both on the outside and the inside before beginning the weaving. Real rush consists of two or three leaves of the flag or cat-tail plant twisted together to form a thin rope. It is much easier and simpler to



Drawings of two seats, one of all-wood construction, the other with iron legs and wooden frame

buy so-called fiber, which is really strong paper twisted by machinery to form a rope of uniform thickness resembling rush. Fiber may be had in thicknesses of 3/32, 4/32, 5/32, and 6/32 in. It is also sold in different colors. About 3 lb. will be needed for this job.

Number the long rails 1 and 2, and the short ones 3 and 4. Cut off a piece of fiber a few yards long and fasten one end with a tack on the inside edge of rail 1. Bring it back and over rail 1, under 2 and back over it, under 3 and back over it, under 4 and back over it, and so on from corner to corner. When the starting point has been reached, the process is repeated. Add a new length by tying it to the last one with a square knot.

List of Materials

STOOL WITH TURNED LEGS

No. of Pieces	Description	T.	W.	L.
4	Legs	1 3/4	1 3/4	17
3	Stretchers	1 3/4	1 3/4	27
2	"	1 3/4	1 3/4	13
2	Rails	1 3/4	1 1/2	13
2	"	1 3/4	1 1/2	27
3	lb. 6/32-in. fiber			

STOOL WITH IRON LEGS

No. of Pieces	Description	T.	W.	L.
4	Leg assembly, iron	3/4	1	21
4	"	3/16	1	17
2	"	1/4	1	7
2	Stretcher, iron	3/16	3/4	30
2	Rails, wood	1 3/4	1 1/2	27 1/2
2	"	1 3/4	1 1/2	13 1/2
8	Blocks, "	3/4	1 3/4	1 3/4
8	"	3/4	1 3/4	1 3/4
3	lb. 6/32-in. fiber; 4—1 1/2-in. No. 10 roundhead screws; rivets, etc.			

Note: All dimensions are given in inches.

Use a wooden stick and a hammer to force the strands together. The hollow space formed between the upper and lower strands should be filled with newspaper.

When the two short rails are completed, the fiber is just woven back and forth between the two long rails as shown in the sketch. Finally the end of the fiber is fastened on the underside by pushing it under a few of the strands. Give the fiber two coats of varnish or white shellac.

The metal legs for the other seat are made of 1 by 1/4 in. and 1 by 3/16 in. band iron. Lay out a full-size drawing of the leg assembly by ruling off 1-in. squares on a board as shown in the detail drawing. Bend the 3/16- and 1/4-in. iron accordingly, and drill holes for the rivets. If it is a good grade of iron, it may be bent cold, but better results are obtained if it is heated. The ends of the legs are spread with a hammer to form feet, after which the shape is worked out with a file. Rivet the two 3/16-in. pieces to the central 1/4-in. piece; then rivet the two 1 by 1/4-in. legs to this assembly. The brace or stretcher is made from two 3/4 by 3/16-in. pieces, bent and riveted as shown.

The iron may be cleaned with steel wool, given a coat of flat, black paint, high-lighted by rubbing with No. 1/2 emery cloth, and finished with a coat of clear lacquer.

The wooden frame is joined in the corners with slip joints, after which four 1/4-in. blocks are glued to each corner as shown on the drawing. The frame is securely fastened to the legs with four 1 1/2-in. No. 10 roundhead screws.

The purpose of giving the fiber two coats of white shellac is to provide it with a surface that will keep reasonably clean. As an alternative method of finishing the wood, try rubbing it down between coats with steel wool and polish the last coat with a furniture finisher's brush, or a nail brush, powdered pumice stone and crude oil.

Skill in applying the fiber so that it remains uniform will come with practice.



"BET YOUR LIFE IT'S Fun WHEN YOU PLAY THE HARMONICA"

• Don't envy other boys and girls who get in on all the good times and are the center of attraction wherever they go. There's no reason why you can't have just as much fun yourself. Good looks or athletic ability are not needed. In fact, you don't need any special talent whatever. Anyone who wants to can learn to play the harmonica—and once you're an expert you can't help but be always in the limelight.

This is an accomplishment that fits you into all kinds of gatherings. Boys and girls who once were worse off than you are now doing the entertaining at parties, outings, church affairs, scout meetings, etc. Many more are to be found in harmonica bands that have been organized in thousands of schools and scout groups throughout the country. What these others have done, YOU also can do.

Here's How To Learn

Even if you do not now know a single note, you can learn to play the harmonica quickly and easily the Hohner way. Our new book: "The Art of Playing the Harmonica"—full of easy diagrams and simple lessons—tells the whole remarkable story of how to play this most fascinating of instruments. The Hohner book is sent absolutely without cost or obligation. Follow its simple directions carefully and in a short time you will be able to give your friends the surprise of their lives.



A lot of big boys love the Harmonica too. Here's what Dizzy Dean the famous St. Louis pitcher says. "Do I play a Harmonica? You bet I do. I've played a Hohner Marine Band for years and it's a winner."

Hohner Harmonicas "The World's Best"

The kind of harmonica you use can make all the difference in the world in the quality of your playing. Hohner

Harmonicas have a world-wide reputation for beauty, accuracy of tone, and perfect standards of construction. They are the choice of leading professionals for stage and radio work—and of thousands of harmonica bands in all sections of the country. Make sure that the instrument you buy is a HOHNER and you can be sure of absolute satisfaction. *Accept no "just as good" makes. Look for the name HOHNER on the box and instrument itself.*

Take First Step to Popularity Now Send For FREE Instruction Book

So if you're sick and tired of staying at home,—and if you really want to step out as one of the leaders in your crowd—don't lose another minute. Tell us where to send your FREE copy of "The Art of Playing the Harmonica." Once you have this book you'll see how easy it is to be a real entertainer—how easy it is to get your share of fun and good times. Send the coupon below—NOW!

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Please send me without cost your free instruction book "The Art of Playing the Harmonica."

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Please address Canadian inquiries to Hough and Kohler, Ltd., 468 King St. West, Toronto, Canada.



TRAINS UNRULY HAIR

—to stay put!

**Costs but a few cents to use
—a bottle lasts for months**

IS YOUR HAIR difficult to keep in place? Does it lack natural gloss and lustre?

It is very easy to give your hair that rich, glossy and orderly appearance so essential to well-groomed boys. Just rub a little Glostora through your hair once or twice a week—or after shampooing, and your hair will then stay, each day, just as you comb it.

Glostora softens the hair and makes it pliable. Then, even stubborn hair will stay in place of its own accord.

It gives your hair that natural, rich, well-groomed effect, instead of leaving it stiff and artificial looking as waxy pastes and creams do.

Glostora also keeps the scalp soft, and the hair healthy by restoring the natural oils from which the hair derives its health, life, gloss and lustre.

Try it! See how easy it is to keep your hair combed any style you like, whether parted on the side, in the center or brushed straight back.

A large bottle of Glostora costs but a trifle at any drug store and will last for months.



Glostora
FOR THE HAIR

TRICKS IN TABLE-TOP PHOTOGRAPHY

(Continued from page 70)



Galleon at sunset—a photograph taken with a small hand camera as shown at the right

POPULAR SCIENCE MONTHLY blueprints; the sky was builder's composition board, the sea was crinkled red wax paper, and the spray was cotton. The other ship picture was a model in a sea of red wax paper with a white sheet for the sky. The sunset in this and the factory view were obtained by placing a photo-flood bulb under the table and directing its light on the white sheet background. A second light, diffused and of much less brilliance, was directed on the camera side of the setup in order to record a slight suggestion of detail.

A minutely detailed model can stand a disclosing light from the front, but a less careful arrangement can be made astoundingly realistic by placing the main light source at one side or in back and photographing shadow or silhouette effects.

After the model is completed, the next step is to make the negative. Choose your camera position carefully. As a rule, it pays to work close to the subject and, unless you want a bird's-eye view, keep the camera low. Working close with a lens will require that it be stopped all the way down to the smallest opening.

A few trials should give you a good negative. From this a contact print or an enlargement is made on single-weight, white stock paper. I prefer the enlargement for a number of reasons, one of which is that it permits extensive trimming of the negative without sacrificing size in the finished print. Strive for an arrangement that will be pleasing to the eye. The print for our purpose must be heavier and darker than a normal one. Positive detail in the highlights is, in most cases, necessary.

Examine the finished print. Do you want to darken any tones or add any dark details? If so, place the face of the print against a window or on a piece of glass with a light underneath and make additions on the back with a pencil. The pointed crest of waves and the smoke from the destroyer's funnels were made in this way. So were the power lines in the factory scene.

From this "retouched" print, a paper negative is made by placing the print in contact (emulsion to emulsion) with an unexposed sheet of single-weight white photographic paper. This may be done in a photo printer or a printing frame. Light passes through your print to the unexposed sheet and, when this is developed, the result is a paper negative. Time will probably be saved if you make sev-

eral paper negatives, varying the exposure and using papers of different contrast.

The back of the negative is worked up the same as the positive print, but this time, although we are adding black, these areas will be lighter or white on the finished print, depending on the strength of the pencil work. The highlights on the spray and the white caps in the destroyer picture and also the light in the stern lantern of the old-time ship were added in this way.

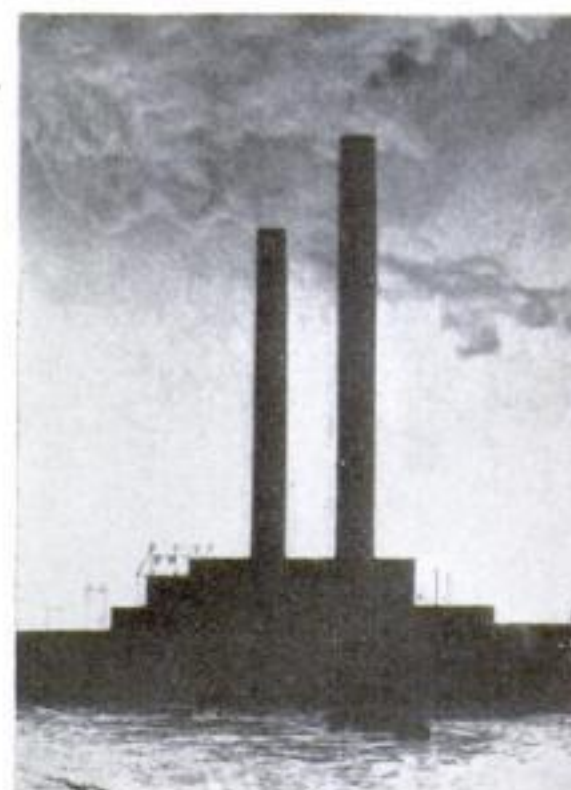
The paper negatives are used the same as glass or film for making the finished contact print. I use glossy single-weight paper for



This is how the galleon picture was taken. Note arrangement of lights for sunset effect

the preliminary steps but now, for the final print, a choice should be made of the most appropriate of the many attractive tints and surfaces obtainable.

A further advantage is the fact that no expensive equipment is required. The pinhole camera, except in its lack of speed, is better for most of this work than the most costly camera you could buy. If you do not have an enlarger, a photo finisher will make an 8 by 10 in. enlargement from a small negative for a dollar or less. Some photo paper, film, an 8 by 10 in. printing frame, two or three trays, and a few chemicals and pencils are all you need to start work. A word of caution before closing—don't use the pencil too much.



The factory is cardboard; the water, a sheet of tinfoil. The clouds are wads of cotton

Keep **HAPPY** with **COOL** shaves



There's no such thing as a hot shave for any man who uses Ingram's Shaving Cream and a good blade. Every shave is *cool*.

Three special ingredients of this rich, foamy lather take out all the stings and jabs, tone the skin, and shield it against scuffing and rawness. No burning, no smarting, no need for a lotion. Your face feels fine without it.

Your first tube or jar will convince you that an Ingram's shave is the world's best. Inexpensive, too. Ingram's lathers so freely that you need far less cream to tame your whiskers. Try it.



TRY THE WORLD'S COOLEST SHAVE

INGRAM'S SHAVING CREAM

BRISTOL-MYERS CO., Dept. J-65
110 Washington St., New York, N.Y.

I'm hot about cool shaves. Let me try a 10-shave tube of Ingram's, FREE.

Name _____

Street _____

City _____ State _____

Concrete Mixer Made from Steel Barrel and Junked Parts

A SMALL but sturdy concrete mixer can be made very reasonably from parts obtained at a farm-machinery or auto junk yard. The required material is: a steel barrel; two idler pulleys 4 in. in diameter with $\frac{3}{4}$ -in. face, and bearings for each; a drive pulley about 14 in. in diameter and clutch, which

The ring gear and a short axle are bolted to the bottom of the barrel. The axle must be centered properly to prevent wobbling. Pivot the frame *B* ahead of its center of gravity so it will rest on the stand until tilted.

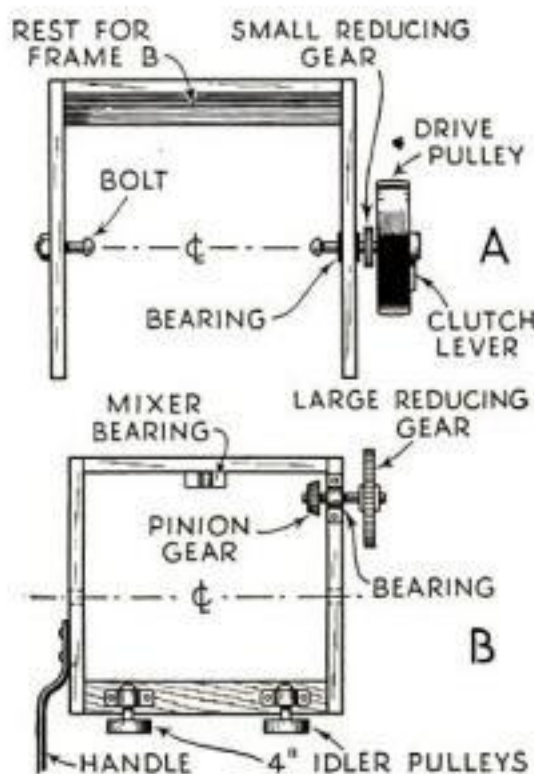
Four 3-in. baffles of heavy sheet steel are fastened with angle irons inside the barrel. If portability is of prime importance, a pair of old auto wheels and a trailer hitch can be added to the assembly.



To empty the concrete, the barrel and the framework on which it rests are tilted forward

can be retrieved from farm-machinery junk; a chain reducing gear; a ring gear and pinion assembly; some 2 by 4 in. and 2 by 6 in. lumber, and assorted bolts and nuts.

The drive pulley is mounted on the side of a frame of 2 by 6's, open at the front as seen in one of the photographs and at *A* in the diagrams. The pinion and reducing gear are mounted on a frame of 2 by 4's, along with the bearings for the mixer barrel, as shown at *B*. This frame fits within the heavier outer framework.



Top views of the main framework (*A*) and the auxiliary frame, (*B*) for supporting the barrel



A rear view of the mixer to show in detail the ring gear and method of driving the barrel

NEW DRILLS WARMED UP TO REDUCE BREAKAGE

BY WARMING up the points of new twist drills before use, much drill breakage may be prevented, especially of the larger sizes. The drill is warmed by feeding the lip into the work and allowing it to run there for one or two minutes. Broach breakage can be avoided similarly by heating the broaches in a trough of water having a temperature of about 80 deg. F.—HARRY KAUFMAN.

National Model CONTEST



S.S. "NORMANDIE"

● Build an exact scale, electrically lighted model—18 inches long

4 BIG PRIZES!

AND MANY OTHER PRIZES

1. A Round trip to France
2. A Round trip to France
3. A Long Cruise
4. A Short Cruise

Every one entering the contest will receive a beautiful commemorative medal.

SPECIAL MODEL KIT, \$1.50

● A complete kit has been specially designed to simplify building. It includes a hollowed hull easily assembled from factory-cut Balsa wood parts. All other necessary materials are provided such as wood for the superstructure, mast, rudder, paints, brush, sandpaper, electric lights, wire, model builder's knife and cement—nothing else to buy. Life boats, anchors and propellers furnished fully finished.

● Full-sized plans are included, showing all steps in construction, and a picture of the Normandie in full colors. Any one handy with a knife can complete a realistic model.

● Entry blank, contest rules, list of prizes and judges' names included in each set.

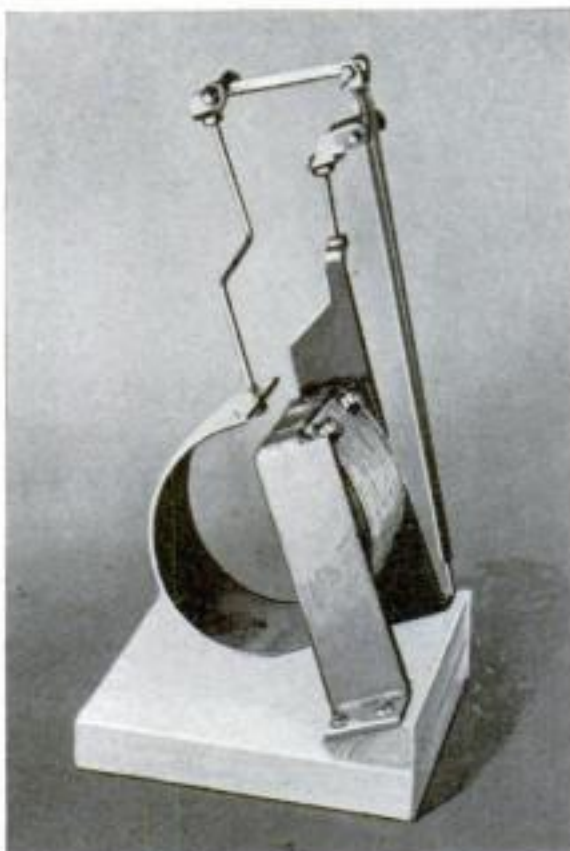
NO AGE LIMIT—OPEN TO BOTH SEXES—Contest starts April 15, 1935—closes February 15, 1936. Model kits may be bought at department stores, sporting goods dealers, and hobby shops. Or direct from us (\$1.50 plus 25 cents for postage and packing).

MODEL BUILDERS' GUILD

DEPARTMENT A, HEMPSTEAD, NEW YORK

MAXIMUM AND MINIMUM THERMOMETER

(Continued from page 63)



A view of the thermometer mechanism from the side to show method of mounting the element

points in a lathe whirling at high speed; or in the absence of a lathe, a hand drill clamped in a vise will serve. Since the durability, as well as the free action of the bearings, depends on the smoothness of the parts, it is a good idea to finish off the points with a fine razor hone before hardening them.

For the pointer, cut a strip of thin aluminum $\frac{3}{4}$ in. wide. This, folded lengthwise, is clamped between two boards, and the protruding edges are flattened down, forming a T-section. Trim to shape and solder or rivet to the clevis.

When assembling the lever system, adjust the bearings so that the pointer shifts with a slight touch on the element arm, even though no lost motion can be detected when the pivots are felt with the fingers. If all bearings are not in alignment, make needed changes by turning the bearing screws, or by bending the link, the arm, or the pointer.

The case is a simple box with butt joints. To keep the temperature inside the same as outside, bore many holes, and cover them inside with screen wire to keep out insects. Mount the thermometer with screws passing through one end, tilting it with the base block under the feet, and check the pivot distances.

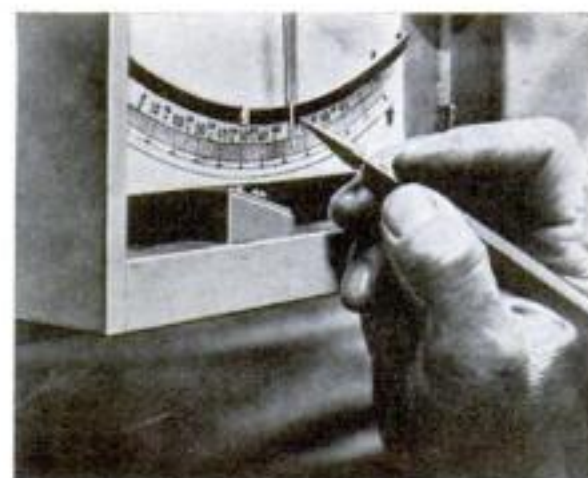
Use $\frac{1}{4}$ -in. plywood for the dial mounting. Cut it to fit loosely, bore a hole for the frame screw, and clamp it with the nut. Screw the lower edge to the base block, and after checking the pointer clearance, paste white paper

over the mounting as a facing for the dial. Now hold a sharp lead pencil at the tip of the pointer and strike an arc across the mounting, supplying the motion by pushing the element arm, not the pointer. The center radius marks the 60-deg. F. point.

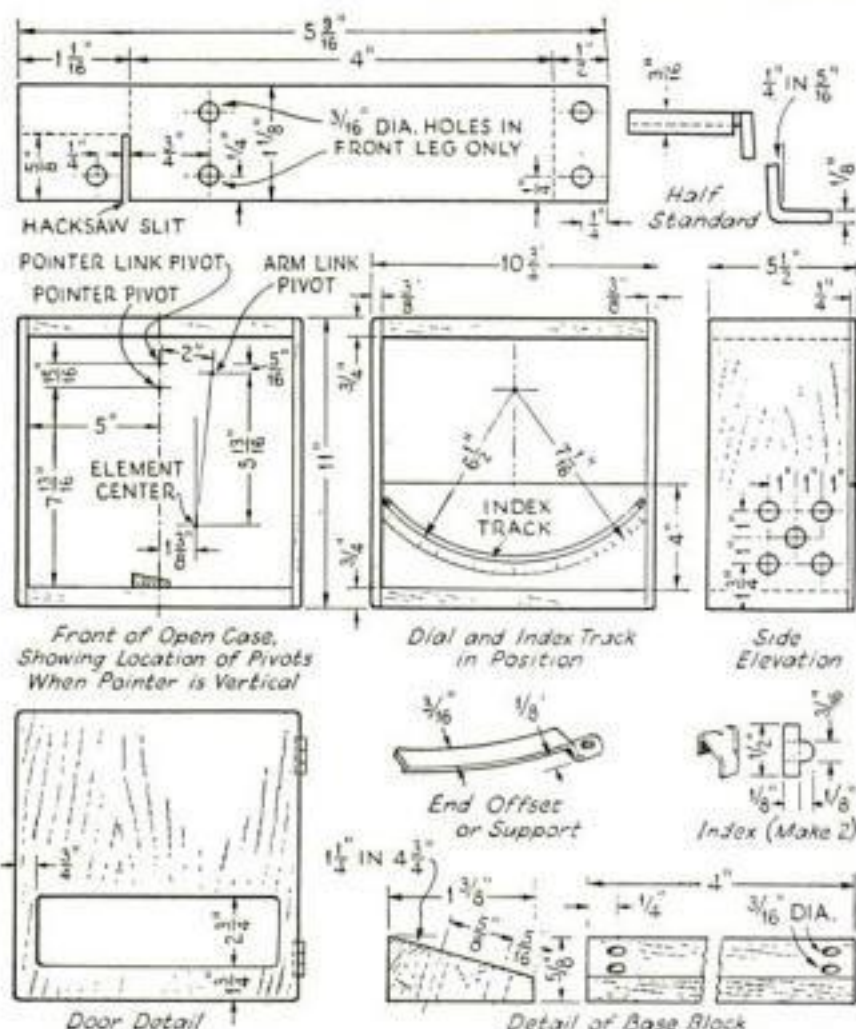
The instrument is by this time ready for calibration. It is necessary to make comparative readings from another thermometer, the most accurate available. Set the test thermometer inside the case beside the element, and take to some corner of a room where a temperature of 60 deg. may be found. Of course, you may not locate this exact temperature directly, but you can start with a slightly lower point and bring it up gradually. Adjust the hand to the 60-deg. mark by bending the element arm slightly. Although shown in a vertical position, the thermometer really will operate more smoothly and accurately if set horizontally and adjusted in that position.

It is quite possible, if you have the necessary patience and ingenuity, to calibrate the scale by experimental means alone, but it is much easier to make use of a calibration curve, which automatically makes allowance for the fact that

(Continued on page 91)



After a reading is taken, the sliding indicators are moved in contact with the pointer



How the case is made; the location of the pivots when the pointer is vertical; the index track and indices; and the base and standard

MAXIMUM AND MINIMUM THERMOMETER

(Continued from page 90)

the levers do not move the hand uniformly. The full-size calibration curve is, however, too large to reproduce in the magazine, but you can obtain it free by sending a stamped and self-addressed envelope to the Home Workshop Department. With it, you need make only two comparative readings, one at 60 deg. and the other at 90 deg. Complete instructions accompany the chart.



How the case looks with the plywood door closed

Next make a track for the indices. Use brass $3/16$ or $1/4$ in. wide and about $1/32$ in. thick. Bend it edge-wise into an arc of $6\frac{1}{2}$ -in. radius, shaping the ends as detailed. To support the center, drive a couple of brads into the dial mount and solder the track to the heads after screwing down the ends.

The indices are inverted U's of light, thin metal straddling the track, with curved flanges turned up to catch the pointer. To set them, put one on each side of the pointer in contact with it. The moving hand will push one or the other ahead of it, the index remaining in position as the hand retreats, thus recording the highest and lowest temperatures. The indices move with such slight pressure that almost no correction will be needed, but a test should be made to see how much the pointer is held back, so as to make allowance for it.

Make a plywood door with a suitable win-



Side view showing the offset element arm, the three clevises, and the needle bearings

dow, glazing it with celluloid cemented inside. Hinge it and screw on a hook and eye to keep it shut. Shellac the inside of the case and oil or paint the outside.

When taking air temperature with this thermometer, keep it out of direct sunlight and shield it from radiation from walls and ground. If it is to be set up in a shelter similar to that described in the preceding issue (P.S.M., May '35, p. 63), put blocks on the bottom to allow free circulation of air.

Quick Drying

61

FLOOR VARNISH

from
Coast to Coast
— Hudson's Bay
to Panama —
It's NOT Slippery!

North, East, South, West, there's NOT a SLIP in an acre of floors finished with "61". Requires NO polishing. Heelproof, marproof and waterproof on floors, furniture, woodwork and linoleum. At paint and hardware stores. Pratt & Lambert-Inc., Buffalo, N. Y.

PRATT & LAMBERT PAINT AND VARNISH

Paddle your own canoe



AN OLD TOWN CANOE brings the thrill of all outdoors. It's so easy to go places in a canoe. Hunt. Fish. Camp, Indian-fashion. It's easy to own an Old Town Canoe. Prices range from \$68. No expensive up-keep costs. Old Towns are light to carry or ship. Responsive. Tough and leak-proof. Send for a free catalog showing models. Sailing, square-stern and sponson canoes. Also outboard boats, including big, fast, seaworthy craft for the family. Rowboats. Dinghies. Write now. Old Town Canoe Co., 196 4th St., Old Town, Maine.

"Old Town Canoes"

All this fun for \$55



The SPORTSMAN

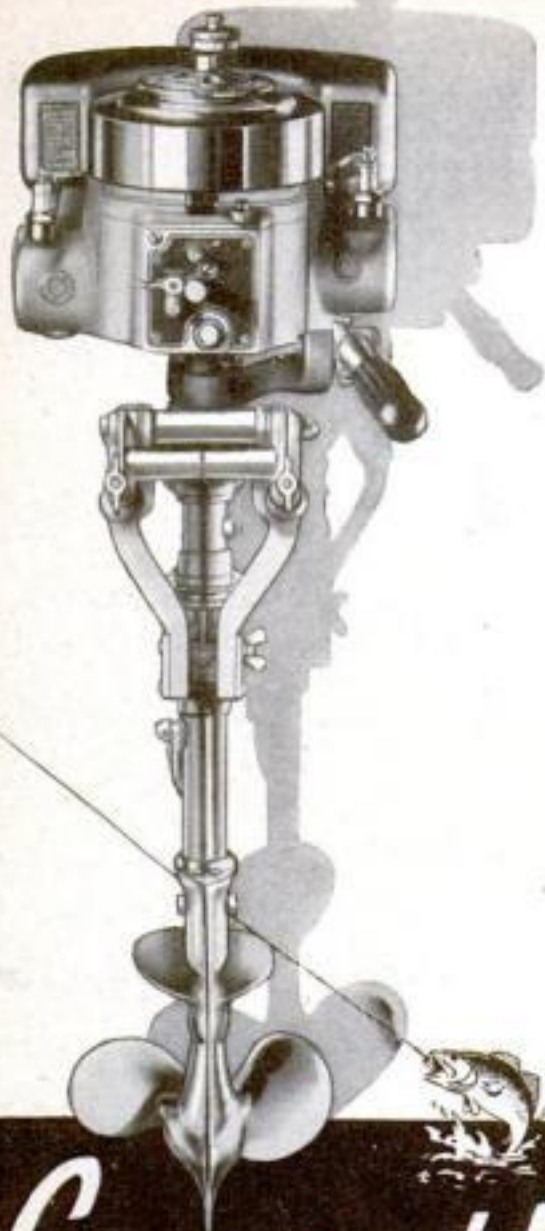
Only \$55 for a genuine EVINRUDE that makes any rowboat a motor-boat! Cruise up to 7 miles an hour; discover new vacation and fishing spots; be fresh when you get there.

World's Lightest Outboard

Evinrude Sportsman weighs only 24½ lbs., is easily carried in one hand, requires little space in auto or Pullman. Newest streamline Hooded Power design. Gallon of fuel lasts over 2 hours. Complete with Underwater Silencing, Automatic Tilt-Up, Flexo-Rubber Steering, and other advanced features. Catalog shows complete line. Write today, EVINRUDE, 4486 N. 27th Street, Milwaukee, Wis.

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EVINRUDE



Compact!

THE NEW AERO-BUILT 300

● New! Johnson's latest and greatest contribution to outboard motoring. The world's smallest all-purpose, full-power twin—embodying advanced features of aeronautical design. New compactness, greater portability, greater power, easier starting, easier handling, flashier performance, longer life!

It's the motor that has everything. 30 important outboard developments. Not a feature lacking—everything you need!

And that applies to every model in the brilliant 1935 Sea-Horse line—from the Single (the Little Aristocrat of outboard motoring) to the Super-power Big Twin. New illustrated Handy Chart tells the whole story. **FREE** Write for copy.

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JOHNSON

Sea-horse OUTBOARD MOTORS



NEW Construction Kit

FOR AN ILLUMINATED SHOW-BOAT MODEL

IF YOU want to take up the fascinating hobby of ship-model making with the least waste of time, effort, or money, the best way is to use our construction kits. It doesn't matter whether you prefer to start with a miniature model of soft balsa wood that can be made on the kitchen table with no tools but a razor blade, pocketknife, and pliers, or a large and elaborate scale model that will be worth several hundred dollars when finished. We have kits of all kinds.

A fine example of a beginner's kit is our new illuminated show-boat model. It is easy to build with the materials supplied, yet is an unusually colorful and decorative model. The kit with full-size blueprint, including lamp and battery, costs only \$1.50 postpaid anywhere in the United States. The blueprint alone can be obtained for 25 cents (see page 78).

For convenience, our ship-model kits have been divided into three classes. The standard models are the largest and most completely detailed, although well within the capacity of anyone who is willing to proceed patiently from step to step and who knows how to use ordinary woodworking tools. The simplified models are of the same general construction, but very much smaller and easier to make. The hulls are supplied semifinished. Still simpler are our Model-of-the-Month Club kits, all of which (except *H. M. S. Bounty*) are made mainly of balsa wood.

The complete list is as follows:

STANDARD SHIP MODEL KITS

- A. Whaling Ship *Wanderer*, 20½-in. \$6.90*
- AA. Same with hull lifts sawed 7.40*
- D. Spanish galleon, 24-in. 6.45*
- DD. Same with hull blocks shaped 6.95*
- E. Battleship U.S.S. *Texas*, 3-ft. 6.95*
- EE. Same with hull lifts sawed 7.45*
- G. Elizabethan galleon *Revenge*, 25-in. 6.75*
- GG. Same with hull blocks shaped 7.25*
- L. Farragut's flagship *Hartford*, a steam-and-sail sloop-of-war, 33½-in. hull 7.95*
- LL. Same with hull lifts sawed 8.45*
- Q. Privateer *Swallow*, 12½-in. hull with lifts sawed to shape 4.95†
- V. Clipper *Sovereign of the Seas*, 20½-in. hull, with lifts sawed to shape 4.95†
- Y. Trading schooner, three-masted, 17½-in. hull 4.90†



KIT O—An 11-in. model of the S. S. *St. Louis*



S. S. *Atlantic*

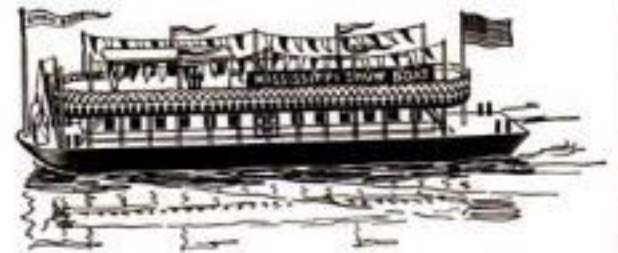


S. S. *Savannah*

Three Famous ships. The two small ones are in one kit



KIT J—*Sea Witch*



KIT 1M—An illuminated show-boat model

SIMPLIFIED SHIP MODEL KITS

- F. Liner S.S. *Manhattan*, 12-in. 1.00
- H. Cruiser U.S.S. *Indianapolis*, 12-in. 1.50
- J. Clipper ship *Sea Witch*, 13-in. 1.50

MODEL-OF-THE-MONTH KITS

- M. Aircraft carrier *Saratoga*, 18-in. 1.00

COMING NEXT MONTH A Scale Model of the *NORMANDIE*

THE world's greatest liner, the French ship *Normandie*, is about to make her maiden voyage. She is such a beautiful vessel that we have had Theodore Gomme build a 20-in. model of her especially for **POPULAR SCIENCE MONTHLY** readers. The plans and instructions will be published in the July issue. Don't start to build a model of this magnificent ship until you see these plans, because they were prepared from the latest blueprints of the *Normandie*, sent from France through the courtesy of the French Line.

NO. 5



KIT A



KIT NO. 2



KIT U—*Hispaniola* of "Treasure Island"



KIT X—A 12½-in. model of S. S. California

- N. Four U.S. destroyers, each 6¼-in... .75
 O. Liner S. S. St. Louis, 11-in..... 1.00
 P. Cup yacht Rainbow, 7½-in..... .75
 R. U. S. cruiser Tuscaloosa, 11¾-in... 1.00
 S. S. S. Savannah (first steamship to cross Atlantic), 3½-in., and S. S. Atlantic, 6-in. (two models in one kit)..... .75



KIT Q

This is the privateer Swallow, a model with 12½-in. hull

- T. U.S.S. Brooklyn, armored cruiser in Spanish American War, 8-in..... .75
 U. Hispaniola, the ship in "Treasure Island," 7-in..... .50
 X. S. S. California, 12½-in..... 1.00
 Z. H.M.S. Bounty, 11½-in..... 1.50
 IM. Show boat, illuminated, 14-in..... 1.50

FURNITURE KITS

- No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble, but without finishes..... 5.40*
 No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¾ in. high over all. Ready to assemble and stain included..... 5.75*
 No. 5. Solid rock maple hanging wall rack with one drawer, 19½ in. wide, 33¼ in. high. Ready to assemble and stain included..... 5.75
 No. 6. Solid rock maple butterfly table, top 19 to 22 in., height 22½ in. Ready to assemble and stain included..... 6.90*

NOTE: If you live west of the Mississippi River, add 50 cents to all prices marked with an asterisk (*) and 25 cents to all prices marked with a dagger (†). Otherwise all prices are postpaid anywhere in the United States. The kits marked with an asterisk or dagger will be sent C.O.D. upon request, but the purchaser will have to pay 28 cents additional upon delivery.

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 353 Fourth Avenue, New York, N. Y.
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Name

Address

City..... State.....
 (Print name very clearly.)

Remit by money order, check, or registered mail. No kits selling for less than \$4.00 can be sent C.O.D. This offer is made only in the United States.



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After Cleaning

Have you had your PLUGS CLEANED lately? SAVE GAS by the AC Plug Cleaning Method

All spark plugs get dirty. Oxide Coating, soot, and carbon cause a waste of as much as 1 gallon of gas in every 10. To stop this waste and also cure hard starting and loss of power, let a Registered AC Spark Plug Cleaning Station clean your plugs in the AC Cleaning Machine. Replace badly worn plugs, of course, with AC Quality Spark Plugs—NOW 60c.

AC SPARK PLUG COMPANY

Flint, Michigan St. Catharines, Ontario

Plugs for Canadian market—75c—made at St. Catharines, Ontario



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 Always Ahead in Beauty - Safety - Strength and Easy Riding

Be out in front! Flash by with the leaders—the boys who rate the best; they ride Iver Johnson Bicycles—the only bicycles of their grade.

Balloon or standard tires and the latest equipment. From \$27.50

Have you sent for folder 46B showing models, colors—and all details? Shipped direct if no dealer nearby.

IVER JOHNSON'S ARMS & CYCLE WORKS
 91 River St., Fitchburg, Mass.

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"Look in the Hood and See." Amateurs and professionals rely on Graflex Cameras for their "more interesting pictures." One great reason is the Graflex Focusing Hood. In it you see the picture as you get it.

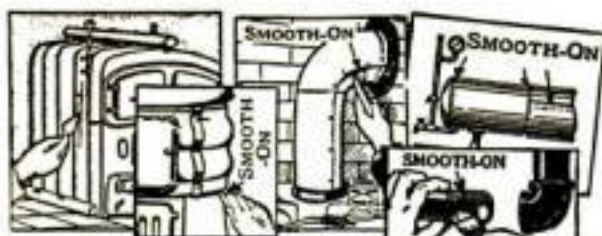


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 32 profusely illustrated pages of absorbing Graflex features. Of interest to every photographer and hobbyist.

Kindly send me without obligation your illustrated catalog and name of nearby GRAFLEX dealer.

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BE THRIFTY!

Do your own
repairing with
SMOOTH-ON No.1

THIS cement hardens into metallic iron, costs little, is easy to apply and makes dependable permanent and emergency repairs that save the householder big sums.

By following directions in the Smooth-On instruction booklet you can stop steam and water leaks from joints or cracks in the boiler, heater, piping and radiators, stop leaks from gas lines, stop leaks of fumes from air furnaces, ovens and smoke pipes, in every instance avoiding a big labor bill and often the cost of a renewal part.

Smooth-On No. 1 is also excellent for re-setting loose screws, nuts, rivets, hooks, hinges, locks, handles, drawer pulls, casters, etc., anchoring bolts and pipe posts in concrete, plugging holes or seam openings in tanks, troughs and pails, tightening loose bases, etc.

Be prepared for emergencies by sending for the free book and keeping a can of Smooth-On No. 1 in your workshop. Get Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. can from any hardware store, or if necessary from us direct.



Write for
FREE BOOK



Do it with SMOOTH-ON

GUARANTEED ONE YEAR

1935 Models
Benjamin-Super
Single Shot Air Rifles
--Bolt Action--Hammer Fire
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Free--Write Today--get full details of New Benjamin 25 Shot Repeater and New Benjamin cal. .177 or cal. .22 Air Pistols--Free Targets--Special Introductory and Trade-in Offers.

FREE BB MAGIC
FOR SHOOTERS

BENJAMIN AIR RIFLE CO.
625 N. Broadway,
St. Louis, Mo.

WINNERS IN FIRST GUILD EXHIBITION

(Continued from page 59)

finished it. You can't match it for real satisfaction.

"My first feeling when I went to the exhibition and saw all that marvelous craftsmanship was regret—not that I was one of the judges, but because I didn't have a violin of my own on exhibit there. I'll pass up the honor of being a judge any time if you will only let me put some of my work in your show.

"I realize how much it must mean to carry off one of the prizes. That's a real achievement. Besides, you've got something to show for it. I can just imagine what a fine feeling it is to win one of these beautiful silver cups and a hundred dollars—real spendable dollars—in cash; then to be able to go home," he added with his humorous drawl, "and show your wife—the cup!"

"The advantage of holding this exhibition and this friendly competition among yourselves," he resumed, becoming serious again, "are such that I hope you will do it every year. It's good work the Guild is doing, and we'll all benefit by its success."

Following Mr. Wons, Howard Vincent O'Brien gave the following address:

"Now that you have dined well, I trust that all of you—even those who failed to win prizes—will be content to let bygones be bygones, and concede that the judges, though misguided, were honest. Certainly they were conscientious.

"I think you were fortunate in the judges you had—particularly in having me. I say that because I claim the world's championship for the largest number of mistakes per workshop hour; and being a master of mistakes, I was able, as a judge, to go unerringly to the source of error.

"Many of you will be disappointed because you failed to win a prize you wanted. I once had the experience of winning a prize I did not want. As a student officer, I was assigned the job of mapping the Fort Sheridan reservation. This was done with a planetable, sighting the elevations every few rods. Those of you familiar with the flatness of our middle western terrain, will appreciate the magnitude of my achievement when I tell you that when I had finished my task and returned to my starting point, I was some 14,000 feet higher than the Matterhorn! This performance was so highly regarded by the authorities that my map was hung in the headquarters office, where, for all I know, it still hangs.

"As a newspaper man, I would say that this triumph of the National Homeworkshop Guild constitutes news of the first order. If newspapers were not so conventional, it would have screamed heads in all of them, instead of the space being given to news of such trivial character as war and murder. Still, with or without publicity, I believe that this movement—one

of the most significant and hopeful in modern American life—is destined to spread. It is a cure for the disease of avarice to which America has long been subject. And from this acorn, I am sure that a mighty oak will grow; and the time will come, when as Kipling said:

HIGH-LIGHTS of the GUILD DINNER

Rufus C. Dawes, president of A Century of Progress—"The force and vitality of the movement have now been demonstrated."

Howard Vincent O'Brien, famous columnist—"This triumph of the National Homeworkshop Guild constitutes news of the first order. I believe the movement to be one of the most significant and hopeful in modern American life."

Tony Wons, radio philosopher—"I make violins in my spare time. That's why I understand and appreciate so well the value of the work being done by the National Homeworkshop Guild. We'll all benefit by its success."



The first prize novelty—a lion in a cage, both carved from one solid block of walnut

of the most significant and hopeful in modern American life—is destined to spread. It is a cure for the disease of avarice to which America has long been subject. And from this acorn, I am sure that a mighty oak will grow; and the time will come, when as Kipling said:

I am sure that a mighty oak will grow; and the time will come, when as Kipling said:

No one shall work for money, and no one shall work for fame; But each for the joy of the working, and each in his separate star, Shall draw the Thing as he sees It, for the God of Things as They Are.

Mr. Dawes' address was, in part, as follows:

"In the great exhibit of the Ford Company at A Century of Progress Exposition, you must have seen the little shop in which Henry Ford developed

his first gas engine. It was an exact replica of his home workshop, and for it he cherishes a deep sentiment. He seems to me to be the type of man I see before me now, eager to express, by the skill of his hands, his sense of beauty or his idea of technical improvement.

"The force and vitality of the movement founded by Mr. Ryder and Mr. DeLong, and their associates of Rockford, Illinois, are demonstrated by the rapid growth of the National Homeworkshop Guild. In less than eighteen months there have been one hundred and sixty of these clubs founded, and at its first exhibit of the work of these craftsmen there were more than a thousand articles presented. It seems to me you must all derive a great advantage by associating yourselves with others in this work, both to receive the encouragement of their commendation and the assistance of their suggestions.

"In these days we all feel the effects of depression; we are burdened with cares and afflicted with anxieties, and those of you are fortunate who can escape for the time being these burdens and find relief and reinvigoration in the creation of beautiful and useful things with your own hands.

"Mr. Lorado Taft, one of the judges in this contest, remarked to me today that he felt the influence that is created by your organizations will distinctly tend to develop in the American people an



This matchless fruit bowl of myrtle wood won first place in the wood-turning division

(Continued on page 95)

WINNERS IN THE FIRST GUILD EXHIBITION

(Continued from page 94)

interest in artistic achievement and a sensitivity to beauty.

"I feel it an honor to participate in this, the first annual dinner of the National Homeworkshop Guild, and congratulate you, and I congratulate these founders upon the rapid growth of your splendid organization."

At the conclusion of Mr. Dawes' address, the prize winners were announced. The silver cup, representing the grand sweepstake prize, and a check for \$200, both donated by POPULAR SCIENCE MONTHLY, were presented by Mr. Dawes. The other presentations were made by Mr. Ryder, Mr. O'Brien and Mr. Bowman.

The exhibition itself lasted for a full week. It was held on the twelfth floor of the huge building of Hibbard, Spencer, Bartlett & Co., 211 East North Water Street. Special thanks are due to the executives of that company, to Fred F. Threadgold, superintendent, and to H. W. Caldwell, of the hand tools division.

Additional photographs will be published in following issues.

ADDITIONAL PRIZES

Note: Because of the large number of commendable projects, the board of judges awarded numerous prizes in addition to those originally scheduled.

SPECIAL DIVISION—WOOD CARVING

FIRST PRIZE, silver medal—W. I. King, Eugene (Ore.) Craftsman Guild, for a carved statuette of a seated woman.

SECOND PRIZE, silver medal—Charles Stone, Waukegan, Ill., member of the North Shore Craftsman Club, for carved figure, "Diana and Hound."

THIRD PRIZE, silver medal—Alvin L. Boss, Madison (Wisc.) Homeworkshop Club, for carving of a bear.

HONORABLE MENTION, silver medal—Nehemiah Chubb, Waukegan, Ill., member of the North Shore Craftsman Club, for a reproduction of an old Celtic cross.

SPECIAL AWARDS

Silver medal—Arthur S. Lewis, Chicago Premier Homeworkshop Club, for a marionette theatre.

Silver medal—E. L. Burton, Elmira, N. Y., member of the Queen City Homeworkshop Club, for a replica of a common pin turned from wood.

Silver medal—John Matthews, Chicago Premier Homeworkshop Club, for a set of three locomotives for the years 1829, 1899, and 1929.

Silver medal—Dr. S. T. Millard, Topeka (Kans.) Homeworkshop Club, for a model of the battleship *Kansas*.

Silver medal—Alvin Winkler, Chicago Premier Homeworkshop Club, for a Napoleonic model coach.

Silver medal—Roy J. Olsen, Chicago Premier Homeworkshop Club, for a model of Fort Dearborn.

Silver medal—A. O. Stenwick, Red Wing (Minn.) Homeworkshop Club, for a model Viking ship.

Silver medal—Charles Kelly, Borden (Ind.) Homeworkshop Club, for a violin.

Silver medal—Carl Zamansky, Chicago Premier Homeworkshop Club, for a scale model of a Blériot monoplane.

Silver medal—Bruce M. Robertson, Winnebago, Ill., member of the Rockford Homeworkshop Club, for bows and arrows.

Silver medal—J. A. Hill, South Sioux City (Neb.) Homeworkshop Club, for wooden costume jewelry.

Silver medal—E. B. Carpenter, Evansville, Ind., member of the Tristate Hobbies' Homeworkshop Club, for a clock dial.

Silver medal—Merle W. Hedrick, Saginaw (Mich.) Homeworkshop Club, for an emblem of the National Homeworkshop Guild.

Silver medal—T. M. Curry, Hillsdale, Wyo., member of the Cheyenne Homeworkshop Club, for projects in alabaster.

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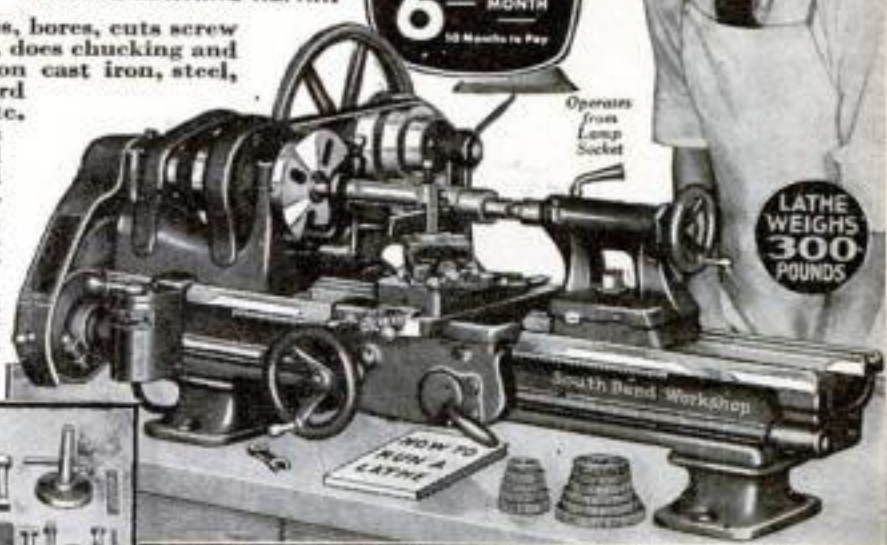
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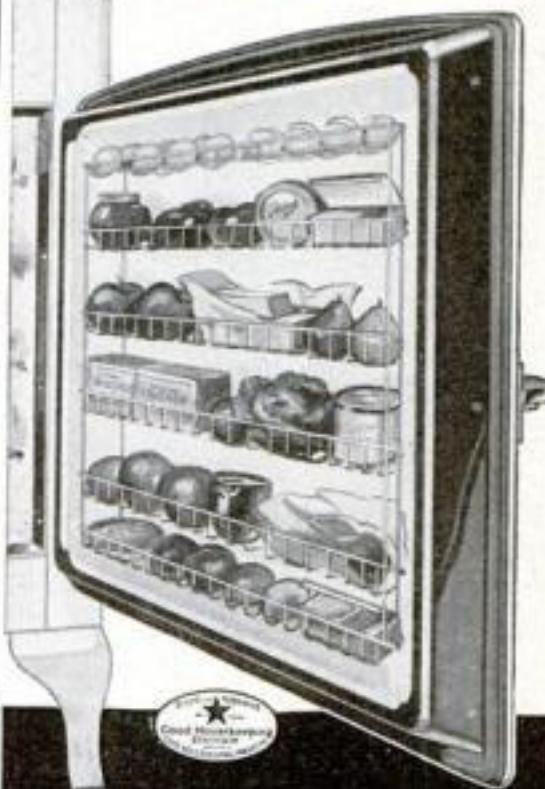
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NEW HOME WORKSHOP CLUBS JOIN GUILD

NEW clubs have been granted charters by the National Homeworkshop Guild as follows: Little Rock Homeworkshop Club, Little Rock, Ark.; South Sioux City Homeworkshop Club, South Sioux City, Nebr.; Covington Homeworkshop Club, Covington, Ky.; the Cicero Homeworkshop Club, Cicero, Ill.; Kingsville Homeworkshop Club, Kingsville, Tex.; Chester Homeworkshop Club, Chester, Pa.; Detroit Lakes Homeworkshop Club, Detroit Lakes, Minn.; Great Falls Homeworkshop Club, Great Falls, Mont.; San Jose Homeworkshop Club, San Jose, Calif.; Hudson Homeworkshop and Hobby Club, Hoboken, N. J.; Indiana Homecraft Guild, Indiana, Pa.; New Bedford Wood Craft Club, New Bedford, Mass.; Spanish Lake Homeworkshop Club, St. Louis, Mo. The last-named club is the second to be organized in St. Louis.

These are in addition to the fifteen new clubs reported last month, and raise the total number of affiliated clubs to 168.

Mount Vernon (N. Y.) Homeworkshop Club. At the club exhibition Charles G. Norton was awarded the Popular Science Craftwork Medal for a wood carving of the head of Abraham Lincoln. George Herman won second prize with a Spanish Colonial doll house (see P.S.M., April '35, p. 67 for illustration), and Herman Richter was third with a scale model electric locomotive made entirely by hand. The vote was very close.

Three Rivers Homeworkshop Club, Three Rivers, P. Q., Canada. Since ninety percent of the population of Three Rivers is French-Canadian, almost every letter and all the Guild bulletins have to be translated into French. J. Henri Dubé, secretary of the club, therefore has an assistant, Donat Bélanger, to aid in the work. J. C. Boissonneault is president.

Topeka (Kans.) Homeworkshop Club. Demonstrations have recently been given by E. H. Johnson and H. M. Wethy on decorative metal work and by Fred Jepson on cement turning.

Waupaca (Wisc.) Homeworkshop Club. A club exhibition was held recently in a store window.

Edison Homeworkshop Club, Chicago, Ill. As many as ten new members have joined the club at a single meeting. G. R. Anthony, a member of the club, demonstrated a new high-speed carver at a recent meeting. The Commonwealth Edison Co. has agreed to provide a meeting room for the club.

Creston (Iowa) Homeworkshop Club. A number of excellent projects were displayed in a local hardware company's window.

Homecraft and Modelmakers' Guild, Richmond, Va. At the club's annual exhibition held at the Richmond Academy of Art, L. J. M. DeJong won the Popular Science Craftwork Medal with a model steam locomotive. Other awards went to J. T. Fordham, Dr. Grove-Hagen, P. E. Inge, and F. W. Harrison.

Emmetsburg (Iowa) Homeworkshop Club. An almost perfect attendance has been recorded at every meeting of the club since it was organized in December, 1934.

National Homeworkshop Guild
c/o Popular Science Monthly
353 Fourth Avenue, New York, N. Y.

I am interested in the home workshop club idea and wish to know what the National Homeworkshop Guild will do for me. Please send me this information in the large self-addressed and stamped envelope I am inclosing.

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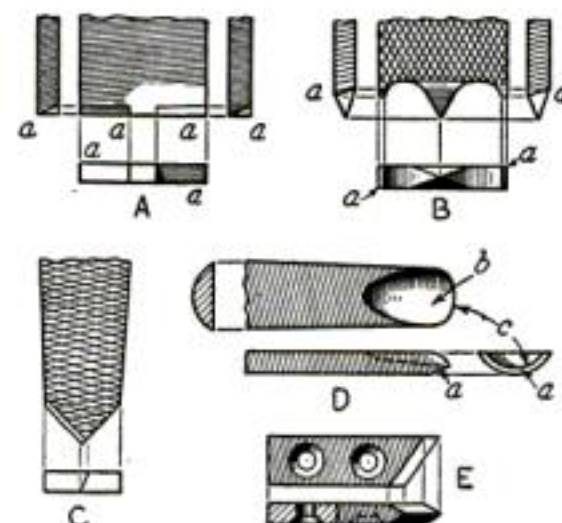
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353 Fourth Ave.

New York, N. Y.

UNUSUAL CUTTING TOOLS MADE FROM OLD FILES



Gouge, socket-hole cutter, countersink, and
other special tools made for emergency use

WHILE it is not a new idea to use old
files or pieces of them for various work-
shop uses, they will make many types of
more or less unusual cutting tools in an emer-
gency.

In the sketch at A is shown an oblong
piece of file with two cutting edges *a*. It was
used in a two-fingered chuck to smooth out a
washer seat on an old plumbing fixture that
could not be replaced.

B is a socket-hole cutter for radio chassis
work. The center for the socket hole should
be made first with a small drill, about $\frac{1}{8}$ in.
The center of the cutter is about $\frac{3}{16}$ in.
longer than the cutting edges. The tool is held
in a brace loosely enough so that the cutting
points *a* both rest on the chassis without lift-
ing.

At C is a small, flat piece of rasp ground
with edges at a 45-deg. angle and beveled.
This makes a good countersink for metal
work. The faces of the edges opposite the
bevels are smoothed to form better cutting
edges.

Sketch D shows a gouge made from a file.
The end is rounded, and the rounded side of
the file ground as at *a* to give an angle of rise
to the gouge when cutting. It is then hollow
ground as at *b* to give the cutting edge *c*.

E is a tool to be rigidly mounted on a
space-winding coil winder and so set that as
the coil form is turned in the winder, the
point of the cutter will make a V-shaped
groove for the wires.

Files and especially rasps are easy to break
evenly if a deep groove is ground around the
part wherever it is desired to break off the
steel.—H. B.

MAN-OF-WAR BLOWS UP

(Continued from page 64)

through the hull. Place the spring in the large
hole with its free end passing through the
small hole. The free end is then bent down
against the outside of the hull and held with a
small staple.

The submarine deck is cut as shown and
glued and nailed in place. The conning tower
is a piece of $\frac{1}{2}$ -in. dowel held in place by the
periscope, which passes through it into the
deck. The periscope is shaped from a piece of
 $\frac{1}{8}$ -in. rod. The trigger is cut to shape and
pinned in place through a $\frac{1}{16}$ -in. hole pre-
viously drilled in the deck.

The torpedo is shaped from a 4-in. length
of $\frac{1}{2}$ -in. dowel, and a $\frac{1}{2}$ -in. washer is
screwed to one end. It is pushed back in the
tube of the submarine and held there by the
lip on the trigger.

The man-of-war and submarine are painted
gray, and the portholes, anchor tubes, peri-
scope, and trigger are black. The target but-
ton and torpedo are red.

WHY DO SOME NEW CARS AGE SO QUICKLY ?

From the moment you get behind the
wheel of your new car, you enter a
race against wear and depreciation.

The car maker has supplied you with
a motor that is a marvel of efficiency.
It gives you more power, more speed,
with less consumption of gasoline
than engineers thought possible a few
years ago. But in reaching this stage
of perfection the motor builder has
used new alloys, new bearings—has
fitted the wearing surfaces closer and
closer together. And all these things
create a new problem in lubrication.

Oil now has only a fraction as much
space in which to flow—and is sub-
jected to greater heat and tension.
Therefore, the opportunity for quick
wear and damage is greater than before.

Thus, the question of "why do some
new cars age so quickly" is definitely
related to the selection of the right
oil and the care used in breaking-in
the motor.

Car manufacturers, generally, are
recommending the use of light oil
(SAE10 or SAE20) to "break-in" the
motor, and several makers suggest
lighter grades of oil for general driv-
ing, even in Summer. However, the
following warning is given:—"one of
the most important factors is the
quality of the oil."

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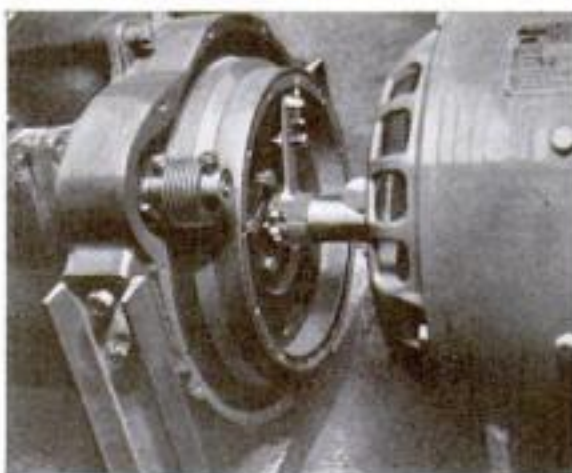
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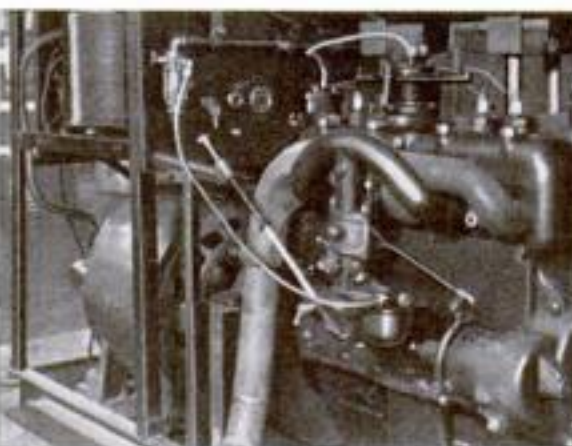
SHOP-BUILT ARC WELDER

(Continued from page 85)



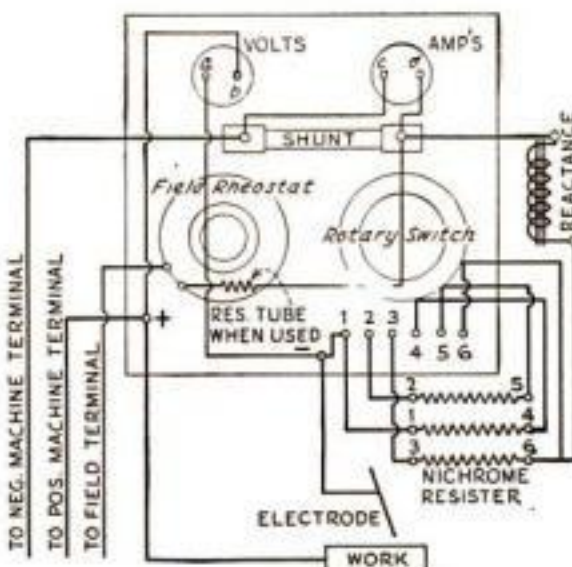
Alignment is checked with a jig made from steel tubing, flat stock, and bolts and nuts

A sheet metal covering is constructed over the entire unit, as shown in the photo at the head of this article. In this view, George R. Cushman, who built the machine, is welding a steel shop stand and demonstrating just how to hold the electrode and hood. The rubber cables and electrode holder are purchased from a dealer in electric welding supplies. The cable must be capable of handling the heavy current used. Note one cable grounded to work with a C-clamp. In work on ferrous metals (iron or steel), the positive connection is grounded to the work as shown in the wiring diagram. In working with nonferrous metals, however, a reverse polarity is often better.



Close-up showing the motor instrument panel and support for the carburetor adjusting rod

The covering over this welder is painted with gray enamel, and the other parts are painted black. This particular welder is to be mounted on the back of a light truck and used for outside jobs. If only shop work is anticipated, four iron wheels of the type found on two-wheeled freight hand trucks and a pull handle should be fitted to the frame.



The wiring diagram. For nonferrous metals, however, the negative side may be grounded

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EIGHTY-METER PORTABLE STATION

(Continued from page 55)

oscillator tuning condenser causes a sudden rise in plate current as indicated by the meter, the circuit is *not* tuned properly. The condenser then should be reset until maximum brilliance of the glow lamp is accompanied by



Diagram shows appearance of front panel

minimum current as shown by the meter. This combination indicates that the oscillator is tuned to resonance.

In neutralizing the amplifier, the neutralizing condenser C_{10} first should be set at its minimum capacity, with the key open. Then, with the neon lamp held near the plate coil of the amplifier stage, slowly rotate the neutralizing condenser until the glow in the lamp is extinguished. Note the reading of the milliammeter in the oscillator stage. It should read exactly as it did when the oscillator was first tuned to resonance. If it does not, the oscillator plate condenser should be readjusted slowly until the oscillator is again in resonance. Finally, hold the glow lamp near the top of the plate coil in the amplifier stage once more. If it glows, the amplifier is *not* neutralized and the neutralizing condenser again must be rotated slowly until the glow is extinguished. Every time a change in the neutralizing condenser setting is made, it is advisable to recheck the oscillator by holding the neon lamp close to the oscillator plate coil.

When you have found a setting for the neutralizing condenser where the lamp will not glow and the oscillator circuit is in resonance, turn your attention to the amplifier-plate tuning condenser. Rotate it slowly. If the lamp glows when held near the plate coil of the amplifier stage, it indicates that the amplifier is *not* completely neutralized. This will necessitate another adjustment of the neutralizing condenser to give a setting where the lamp refuses to glow. The amplifier stage can be considered as tuned only when the oscillator stage is in resonance, as indicated by the glow of the lamp, and when the one setting of the neutralizing condenser is found, that will extinguish the neon lamp. When this spot is located, it should be possible to rotate the plate condenser of the amplifier stage over its entire range without lighting the lamp. Remember, unless the oscillator stage is in resonance, you will get a false indication in the amplifier stage.

When the amplifier is neutralized, the next step is to close the (Continued on page 100)

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EIGHTY-METER PORTABLE STATION

(Continued from page 99)

switch SW₂, hold the glow lamp over the plate coil of the amplifier stage, and rotate the plate circuit condenser until maximum brilliance is obtained. This will indicate that the transmitter is tuned to resonance and ready to be connected to the antenna.

WHILE any type of antenna may be used with the transmitter, the best for portable use is the end-fed Hertz type, consisting of one single wire fed at one end and wired through a condenser into the plate coil at the tenth turn from the plate end of the winding. The length of this antenna should be approximately 132 feet.

In operating the transmitter, the plate current of the two '46 tubes should not exceed 160 milliamperes regardless of the antenna. If higher output is required, the grid leak resistor (R₅) should be shorted out.

The parts required in the construction of this station are the following:

- C1.—Electrolytic condensers (5), 8 mfd., 500-volt.
- C2.—By-pass condensers (5), .01 mfd., 500-volt.
- C3.—By-pass condensers (4), .05 mfd., 500-volt.
- C4.—By-pass condenser, 2 mfd., 200-volt.
- C5.—By-pass condenser, .5 mfd., 500-volt.
- C6.—By-pass condenser, 10 mfd., 25-volt.
- C7.—Coupling condenser, .02 mfd., 500-volt.
- C8.—Grid condenser, .0001-mfd.
- C9.—Variable condensers (3), 140 mmf., midget.
- C10.—Variable condenser, 50-mmf.
- C11.—Trimmer condenser, 10-70 mmf.
- C12.—Variable condenser, 35-mmf., midget.
- C13.—By-pass condenser, .00025-mfd.
- R1.—Resistor, metallized, 25,000-ohm.
- R2.—Resistors, (2) center-tapped, 50-ohm.
- R3.—Resistor, 35,000-ohm.
- R4.—Resistor, 3,000-ohm.
- R5.—Resistor, metallized, 1,000-ohm.
- R6.—Resistor, metallized, 100,000-ohm.
- R7.—Resistor, metallized, 300-ohm.
- R8.—Resistor, metallized, 40,000-ohm.
- R9.—Resistor, metallized, 3-megohm.
- R10.—Resistor, variable, 25,000-ohm.
- R11.—Resistor, metallized, .25-megohm.
- R12.—Resistor, metallized, 50,000-ohm.
- R13.—Resistor, metallized, .5-megohm.
- R14.—Resistor, metallized, 500-ohm.
- R15.—Resistor, bleeder, 20,000-ohm.
- R16.—Resistors (4), metallized, 50,000-ohm.
- T1.—Transformer, power.
- T2.—Transformer, output, for 2A5.
- L1.—Choke, 200-milliamperes.
- L2.—Choke, 60-milliamperes.
- R. F. C.—Chokes, radio-frequency (3), 2.1-mh.
- X.—Crystal (80-meter) and holder.

Miscellaneous: Tubes, coils, coil form, cabinet, aluminum, switches, wafer sockets, milliammeter (0-200), wire, solder, etc.

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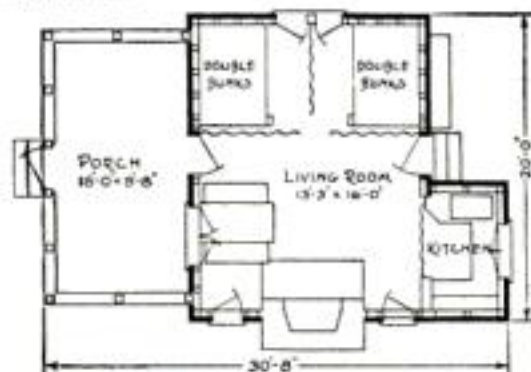


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HAIR AND FEATHERS UNDER THE MICROSCOPE

(Continued from page 41)

thing for the bird that hair and wool do for an animal. However, because a bird is an aerial traveler, the feather must be equipped for the more specialized work of flying. There are, on birds, three general types of feathers; namely, filoplumes, down feathers, and contour feathers. Of these, the contour feathers are most complicated.

THE larger end of the central stem of a feather is the quill or calamus. This part is hollow and partly transparent. The quill, as you proceed from the body end outward, becomes the shaft or rachis (at the distal end) of the feather vane. It is this vane that will be of greatest interest to the microscopist.

With dissecting shears, clip off some of the barbs extending outward in parallel lines from the shaft. Pull these barbs apart—note that it requires comparatively great force to do so—and examine one of them with your microscope. Note how the central part of the barb, made up of a great many oval cells at its larger end, narrows out until it becomes little more than a line of single cells, placed end to end.

By stopping down the substage condenser, you can see that the big end of this central portion is surrounded by a transparent shell, along one side of which is a line of fine strands. Farther along, these strands become larger, and a similar line appears on the opposite side. These strands are the barbules. Examine carefully the barbules on each side. Note that toward their ends the structure changes. Many of the barbules along one side of the barb seem to be notched, or provided with tiny barbicels. Those along the other side are similarly equipped, but many of the barbicels are bent back into distinct hooks.

In these hooks is the secret of the bird's power of flight. Each tiny hook, by catching a projection on one of the barbules of the neighboring barb, helps make the row of barbs function like a single sheet of material. Consequently, the microscope reveals a bird contour feather to be made up of a great many smaller feathers united by countless hooks into one light-weight, efficient, aerodynamic structure. You will not find these same hooks on the down feathers, which keep the bird warm, and do not beat the air or present a smooth surface to the air.

The highly colored feathers of the peacock and other bright-hued birds make beautiful microscope objects for low-power examination. But you will find all body feathers to be in general the same. That is, they will have central stems flanked by two rows of parallel barbs. Each barb will be found to be equipped with barbules and these, in turn, with barbicels, many of which end in tiny hooks. Most downy feathers, which give the bird a heat-insulating layer that builders of houses are beginning to imitate, are seen to be very loosely constructed. They are made up essentially of barbs provided with barbules which are not very close together. The barbules are sometimes ribbonlike where they join the barb. Farther out, they appear jointed, very much like jointed plant stems. At the joints, small pointed projections may occur.

IN ALL, you will find the subject of hairs and feathers engrossing. They are not difficult to mount or to observe. Permanent slides are easily made by clipping off bits of feather barbs or hairs and mounting them in Canada balsam. First, remove all oil, by rinsing the specimens in ether; and then saturate them with xylene to make sure that they will be completely covered by the balsam. Make a few dry mounts by spinning a shellac ring on a slide, coating the bottom of the cell thus formed with a (Continued on page 103)

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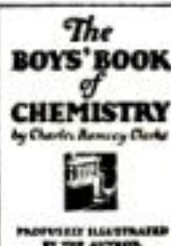
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HAIR AND FEATHERS UNDER THE MICROSCOPE

(Continued from page 102)

very thin layer of balsam thinned with xylol, and then carefully laying the grease-free specimen in position so that the balsam touches only the underside. Let the balsam set, before applying the cover glass. A thin layer of shellac applied freshly to the ring will hold the cover glass in place. It is a good idea to apply a finishing touch by ringing the cover glass with asphalt varnish, gold size, or even ordinary four-hour enamel.

Did you ever hear of wooden microscope slides? They were in common use in England years ago, and are still useful today for opaque specimens. Samples of metal polished to show the grain structure, bits of wood, feathers, small shells, insect parts and other objects that can be viewed against a dark background, with illumination from above, can be preserved on wooden slides. Such slides are more durable than glass, and can be tied into compact bundles for storing or carrying.

MAHOGANY, walnut, thin plywood and similar materials can be used for the slides. The wood should be well seasoned. Various thicknesses will be desired, because the slide should be but slightly thicker than the specimen. After the wood has been sanded smooth on both surfaces, cut it into one- by three-inch strips, for the standard slide size. Mark the exact center of each piece and, with a sharp wood-boring bit, or a jeweler's saw, cut a circular opening all the way through the wood.

With sandpaper, remove splinters. To one side of the slide glue a one- by three-inch piece of cardboard which has been blackened in the center with India ink. The ink can be applied after the cardboard is glued in place. Sometimes it may be desirable not to blacken the cardboard. You now have a one- by three-inch wood-and-cardboard slide with a hollow depression or cell in which to mount the specimen. A bit of balsam spread on the bottom of the cavity will hold the specimen in place. When you have applied a label, your slide will be complete. It is not necessary to cover the cell with a cover glass, although you can do so, if you wish. The glass can be cemented in place with balsam, or held by a piece of gummed paper, with an opening in its center the size of the cell.

From ordinary snap clothespins, you can make various useful devices for handling slides and performing other operations in connection with your fascinating microscope explorations. For example, a suitably altered clothespin which does not have a very strong spring will serve nicely as a clamp for holding cover glasses in position while the balsam hardens.

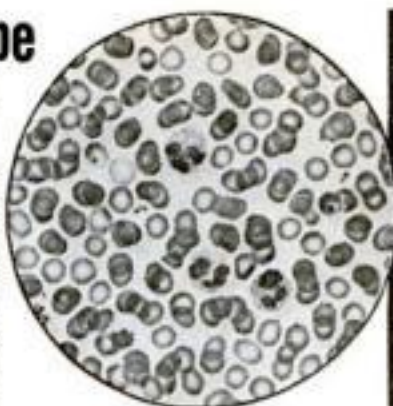
THE altering consists for the most part in whittling the two wooden jaws so that they come together exactly parallel. Cut the wood away from the surface of one of the jaws to a depth about two-thirds the thickness of the slides to be used. If the pressure is too great, take the clothespin apart and bend the spring so that it is a bit less stiff. Too much pressure may crack the cover glass.

This transformation of commonplace snap clothespins into useful laboratory tools can be extended to an almost unlimited degree. A number of cover-glass clamps, and three or four clamps for holding warm slides will be found useful. It is possible to make an efficient test-tube holder from one of the clothespins, by rounding out the jaws so that they will fit snugly around the glass, and by reducing the strength of the spring if necessary. The clothespins can be waterproofed by boiling the wood in paraffin, or applying paint or quick-drying lacquer. Lacquer is best.



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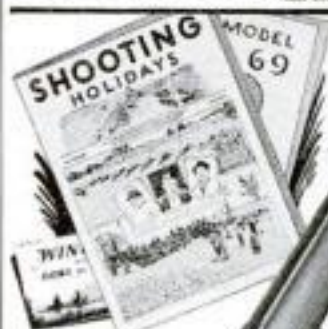
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Many of my friends endeavored to get me located through commercial and even political connections but without success. Several volunteered to make small advances with vague hope of repayment sometime in the nebulous future. Naturally, I refused. But I did agree to accept nominal compensation for helping the son of an old acquaintance over difficult portions of his studies.

The lad was struggling along with a correspondence course in chemistry while still a junior in high school. Mathematics proved to be his stumbling-block. We got on famously and, through his courtesy, I met another extension student—on the verge of abandoning a course in commercial Spanish. His problem was a bit difficult, however, as his ground-work in English had been poor and his home environment was not conducive to serious application. That gave me the idea of the Educational Guidance Bureau—a place where correspondence students and others might study under congenial conditions, at scheduled periods, receive help when and if required, and even enjoy limited social recreation.

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TWO SHIP MODEL HINTS

CASEIN glue as thick as cream is recommended by Capt. E. Armitage McCann to fasten shim copper sheathing on ship models. Nicholas Olotka, a reader, finds that ordinary glue may be used for the same purpose if the copper is first given a coat of clear varnish and allowed to dry. It is best to make a paper pattern before cutting each piece of copper, working from the water line down to the keel.

To make small gratings on the hatches of such a model as the *Swallow*, Wilbert Lowry rules off squares, blackens those to be cut out, and drills holes just large enough to touch the sides of the squares. A medium-sized nail is then filed so that the point is square and sharp, and is then tapped lightly into each hole to cut the corners square.

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AMAZING TESTS PRODUCE RACE OF SUPER-BEES

(Continued from page 15)

how they would solve the problem. Presently I saw the bees grasping the ants with their feet and flying away with them. Some distance from the hive, they dropped them and the next day every one of the invaders had disappeared."

What is believed to be the "Methuselah" of queen bees lived at the Vincennes apiary to the extreme old age of eight years and two months. Ordinarily, queens live much longer than workers. The worker bees have barbed stingers that sometimes remain in the victim and cause the bee to die. The queen, on the other hand, has a barbless stinger shaped like a scimitar, which she can employ over and over again without danger of losing it.

AN INTERESTING discovery in connection with this stinger was made not long ago by a scientist at Johns Hopkins University. "For many years," Smith told me, "it was believed that queens suffered from a sort of paralysis which ended in death. My observations convinced me the condition resulted from the queen accidentally stinging herself. Allan Latham, another apiculturist, and I engaged in a friendly debate on the subject. Finally, the question was solved by an experimenter in the Johns Hopkins laboratory. Taking a photomicrograph of a queen suffering from the paralytic condition, he showed conclusively that the stinger of the bee had passed entirely through her foot."

The only time Smith has been stung by a queen was after he had been handling other queens. The bee evidently was angered by the odor on his fingers. For, the first instinctive impulse of the queen on emerging from the cell is to kill any other queen that may have hatched at the same time. It has a highly developed sense of smell which enables it to locate a rival.

To prevent valuable queens from being killed, Smith locates the queen cells before they hatch and transfers them, with a number of worker bees, to specially designed brooder hives. Here the queens can mature unmolested.

They are shipped to customers by mail. At first, Smith fed them during the journey on the conventional "bee candy." He found they did not thrive on the unnatural diet and suffered from lack of water. So he designed an original shipping case that reproduces, as far as possible, the natural conditions of the hive. It contains a section of real comb honey, a small sponge saturated with water, and thirty or so worker bees to care for the queen. How successful the new method of shipping has proved is indicated in a clipping from a newspaper in Auckland, New Zealand.

"THREE passengers of royal blood," it reports, "arrived by the R.M.S. Niagara in Auckland on December 2. They were queen bees enroute from Vincennes, Ind., U.S.A., to Christchurch, N. Z. When they reach their destination they will have traveled more than 10,000 miles. They were posted by Jay Smith of Vincennes to Vancouver, B. C. and continued from there on their 6,000-mile sea voyage to Auckland. On arrival, they were handed over to a local bee keeper who examined them and pronounced them in very good condition. It is interesting to note that the queens were fed on pure honey. Another package of queens fed on 'bee candy' failed to survive the long voyage."

In raising, cross-breeding, and artificially fertilizing his queens, one of the most interesting experiments Smith is making is an effort to produce bees that won't sting. "Scientists," he says, "have developed spineless cacti and wingless chickens. Why not a stingless bee?"



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RAISING DOGS FOR SALE

(Continued from page 39)

for your pet to reach the proper age, you can be treating it with kindness and accustoming it to handling.

The veteran dog raiser has found that a hungry dog is more likely to pay attention to what you are trying to teach it than one that recently enjoyed a full meal. When he is ready to teach a dog its first trick, he lets it go for twenty-four hours without food. Then, with a bit of hamburger steak, he can work wonders.

THE actual teaching of your dog will consist, for the most part, of putting the dog into the position you want it to assume, and at the same time repeating the necessary command. Do this often enough, being careful to reward the dog with a bit of meat after each successful performance, and your subject will become aware that it is expected to assume the position in question, whenever you give the proper command. Of all the requisites for good training, patience on the part of the teacher is the most important.

Experienced dog handlers claim that a dog does not understand spoken words as readily as most dog owners lead themselves to believe. The average dog understands very little, if anything, of what you say to him, according to these men. Instead, he responds to actions, motions, and sounds. On the other hand, experiments recently conducted in Germany tended to show that dogs learn to understand certain words and phrases, and to distinguish small differences between words.

Many of the troubles experienced by dog owners—troubles that affect the health of the dog—can be traced to improper feeding, in the opinion of dog experts. A dog has a short digestive tract, so that the food with which it stuffs itself almost to the bursting point will, within a surprisingly short time, have been assimilated. A dog's stomach is normally empty. It can go for two or more days without food, and suffer no ill effects. Then it can eat a hearty meal, and within a short time be using the energy contained in the food.

Research on dog foods has revealed the fact that as much as ninety percent of skin troubles are caused by indigestion. Such indigestion frequently is a result of excessive use of cereal foods. Ice cream, cake, or chicken bones never should be given to a dog. The cake and ice cream are not the right kinds of food, and the chicken bones may cause injury.

Just as overeating is the cause of some human ills, so overfeeding can be harmful to a dog. The so-called "worm fits," which cause the dog to run and jump about as if it were mad, are said to be a result of too much food, which causes high blood pressure.

The feeding program followed at a large commercial dog farm calls for about seventy-five percent raw meat and twenty-five percent dog ration and milk. Twice a week the dogs are fed all the raw meat they can eat. On remaining days of the week they are given dog ration and milk, the amount varying with each dog and its physical condition. The dogs are fed once a day, late in the afternoon. After eating, they are inclined to be lazy and to sleep, so that late afternoon feeding assures a night of quiet.

SOME dog owners worry needlessly about the freshness of the meat and bones their pets eat. A dog is so constructed by nature that it can devour spoiled meat without ill effects. In fact, most dogs prefer a soup bone or piece of steak that has been well seasoned by a few days in the earth.

The diseases and ailments to which a dog may fall victim are not numerous, and can be reduced to a minimum by proper feeding. The most serious disease is distemper. Each dog specialist (Continued on page 109)



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RAISING DOGS FOR SALE

(Continued from page 108)

seems to have his own method of treating this disease. The average owner probably will find it best to take his dog to such a specialist. Symptoms of distemper include the loss of appetite, loss of ambition, appearance of matter in the eyes, coughing, and a fever. The normal temperature of a dog is 101 degrees Fahrenheit. If a dog has distemper and recovers from it, it is considered safe from the disease for the remainder of its life.

DOG owners consider mange a more serious disease than it really is, according to one veteran dog man. If their pets develop a bad case of mange infection, they conclude that death will be the inevitable result. Mange, however, is not difficult to cure.

The method followed by this dog raiser is to remove the skin encrustation with a brush, so that the medicine to be applied will penetrate the skin to the organisms that cause the infection. A strong solution of naphtholeum is the medicine used to bathe the dog. Ordinarily, one application of full-strength solution is sufficient. When the infection is severe, covering much of the body, the naphtholeum solution is diluted, and application made by degrees. Otherwise, the weakened dog might die from shock.

Intestinal worms, resulting from the devouring of food infected with the eggs of such worms, sometimes cause trouble. Standard worm remedies can be obtained anywhere. One dog farmer has found that worms in dogs can be prevented largely by worming the mother dog while she is carrying her pups. Somewhat mild doses of worm medicine are given at three-week intervals. The pups will, in most cases, not be bothered by worms.

A simple and inexpensive treatment for fleas, followed at dog farms, is to bathe the animals in strong salt water. Besides killing the fleas, the salt solution has a beneficial action on bites, wounds, and other minor injuries.

Dog-farm operators frequently are asked questions about breeding problems. One of the most frequent queries concerns the production of male pups. The method followed by one dog-farm proprietor is to breed the female from thirteen to seventeen days after she comes into heat. For small dogs, the thirteen day rule is used, and for larger ones, the seventeen-day rule. Most of the resulting pups will be males, this dog specialist claims.

Bathing is another common problem about which the average dog owner seems to be in doubt. Professional dog raisers are of the opinion that too much bathing is harmful. A dog, unlike a human, does not sweat through its skin, but only through its tongue. Therefore, bathing to remove waste materials from the skin surface is not required. Only external dirt accumulates on the skin. Excessive bathing, or improper care while the skin is wet, may upset temperature conditions and cause illness.

IT IS natural for a dog to run on the ground, a fact that seems to be overlooked by many apartment-house dwellers. It is a practice at dog farms to remove pups from their floored pens once a day, and let them play about on the ground for a time.

The business of dog-raising shows no signs of becoming stagnant. Dogs have been in our lives for so many centuries that there is little likelihood of their ever going out of favor, in spite of the damage and trouble they sometimes cause. Visit the nearest kennel where dogs are raised commercially, and if you don't come away with a playful pup, or at least the desire to own one, you are one of those unfortunate individuals who never have learned what a true friend and pleasant companion a dog can be.

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GOOD SAMARITANS OF THE ROAD —THE HIGHWAY PATROL

(Continued from page 21)

saved the man's life, doctors said. One driver was called from his hotel room in the middle of the night to save the life of a truck driver severely cut in a wreck. Another, curious about a dark truck parked by the roadside, found that the driver had been beaten into unconsciousness and robbed as he lay asleep in his truck awaiting repairs. The patrolman gave immediate first aid, then saw to it that the man got proper medical attention.

Fatal accidents and stretcher cases are not so common as might be expected, considering the many, many wrecks I see in the course of a year. Last year I used my stretchers nine times; this year, only once, so far.

SPEED is certainly the chief cause of most highway accidents. Men who drive forty miles an hour around town, go sixty or more on the open road; they do not realize how differently a car handles at high speeds, with heavy loads.

In one freak accident which I happened to see, four men, speeding down the highway, had just passed a car, but as they whipped back to their own side of the road, the rear end swayed and threw their car into a roll. Usually a car will roll sidewise, but this one somersaulted end over end, and threw the men clear. Luckily they were not hurt seriously. Their car immediately took fire and was completely destroyed.

One of our patrolmen was puzzled recently when a car that had been winding the curves ahead of him suddenly disappeared. There was no road intersection and the car had not had time to pass over the horizon. Sensing something wrong, the patrolman retraced his route.

Soon, upon the pavement, he saw clues—not skid tracks, but ordinary wheel marks, leading right over the edge of the canyon. Peering over the rim, he saw the car lying there, a heap of wreckage. Later, as he gave first aid for their injuries, he got the story from the occupants. To light a cigarette, the driver had given the wheel momentarily to a friend whom he told to steer the car straight. The friend complied; he steered him straight to the hospital!

Twelve thousand cars passed safely over a mountain grade in one day. Only one driver failed. His car left the road and crashed into a tree. He was badly injured, but, luckily for him, a highway patrolman was only a few dozen yards away when the accident occurred. The injured driver was carried more than fifty miles to the hospital, and his life, consequently, was saved. On such occasions as this the highway patrol does a most valuable service.

Hitch-hikers often ask us for rides, but rules allow no passengers. Sometimes they get very indignant; they have even threatened to manhandle drivers when refused transportation. Sometimes they stop the driver and ask for a ride to the next town, claiming that they have something in the eye. Another trick is to hold the side of the head and claim to have a foreign object in the ear, and to demand a ride to the doctor.

ONE driver saw a car stopped along the highway, apparently in trouble. He made an inquiry, but was told they were simply giving the baby some needed attention. Just as he was about to drive on, he saw that the car was afire. A few shots with the fire extinguisher quickly quenched the blaze.

You would be astonished at the things people lose from their cars. As a touring car passed one patrolman, a bundle dropped from the rear seat. He thought it was a dog, and sped on, to hail the motorists. The missing "bundle" was a four-months-old baby!

After this experience, the parents were so nervous that the patrolman took the wheel

and drove their car to Santa Ana; there a doctor's treatment apparently restored the child.

Every time he comes to town, a spry little eighty-five-year-old man leaves a cheery word for the auto club patrolman. One day, coming down a grade, he ran off the bank and wrecked his car. His throat was badly cut by the shattered windshield, and his jaw was broken; he lay helpless until the patrol driver came along.

Although we are not policemen, we often are called in to settle affairs which tax our ingenuity. One day in the desert, two prospectors—old partners—became angry and proceeded to fight it out. They fought in a red rage until completely exhausted. I had to handcuff one of them to stop the fight.

After the blood had been cleaned up and they had cooled off a bit, they went right back to the desert together for another prospecting trip.

PASSING through a desert settlement, a patrolman was hailed by a group of citizens who were putting a man through an impromptu third degree. He was the stepfather of two small children who were missing. Neighbors had inquired about the children and, receiving no satisfaction, became aroused. Finally they extracted from him the information that he had abandoned them about forty miles out in the Mojave Desert. The "Good Samaritan" car went out to look for the children while citizens held the stepfather for the police. He found them suffering from lack of water. Soon they would have died in the desert sun.

Of course, we have many amusing experiences as well. Near the Mexican border, during prohibition days, I once saw a truck stalled by the roadside; I slowed, to see if I could help. The three Mexicans with the truck looked at me with suspicion. As I drew alongside, one rattled off a few words in Spanish to the other. Suddenly, like quail flushing from cover, the three men burst across the field. Evidently, my uniform had caused them to mistake me for a prohibition agent.

Another amusing experience proved rather a blow to my dignity. As I unloaded supplies at the office, I was approached by an elderly lady who wore thick glasses. She looked at my white truck, and inquired, in a trembling falsetto, "What do you charge for wet wash?"

ONE MUSICIAN PLAYS ALL FOUR PARTS OF QUARTET

PLAYING all four parts himself, Prof. Vladimir Karapetoff of Cornell University recently produced a phonograph record of a 'cello quartet. Stepping before a microphone, he began by recording the part of the third 'cello. Then he played it back, accompanying it with the second 'cello's part, while the microphone recorded the duet of phonograph and instrument on a new record. The parts for the fourth and first 'cellos were similarly added, and in the final record all four blended together. Since some details were lost in re-recording, Prof. Karapetoff chose the order described so as to have the melody freshest and the bass next to it.

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HERE'S THE ANSWER

(Continued from page 48)

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Duck Carries its Young

H. P. H., ASHEVILLE, N. C. The bird you saw carrying its offspring was probably the wood duck, which is reputed to carry its young grasped in its feet. It is the most beautifully marked of all American ducks.

A Helpful Little Beetle

Q.—I FIND a great many ladybugs in my garden, and would like to know if they should be exterminated.—J. J. S., Somerville, N. J.

A.—THE ladybug or ladybird is a help to you. Do not drive it away. Each ladybug eats about fifty plant lice every day, and feeds upon the eggs of harmful insects, also.

Coal as a Source of Colors

P. J. S., BUTTE, MONT. About 900 different kinds of dyes are made from coal tar. The first one to be discovered, in 1856, was mauve. Coal is therefore of the utmost importance to the drug and dye stuff industries.

'Perpetual Ink'

D. L. K., LOS ANGELES, CALIF. "Perpetual ink" can be made by melting three pounds of pitch over a fire, and adding three-quarters of a pound of lampblack. Stir the mixture well. Its chief use is for filling in letters carved into marble, granite, or some other stone.

A Swimming Lizard

B. C. C., BUFFALO, N. Y. Your friend is right in his assertion that some lizards can swim. The New York Zoological Society reports hundreds of sea iguanas in the Galapagos archipelago. The sea iguana is a lizard. When it is swimming, it keeps its legs close to its body and agitates its tail and body as a fish does.

A Matter of Weight

I. C. B., VOLANT, PA. A bird flying into the mouth of a large jar, and around, inside the jar, without touching the sides with its wings would, nevertheless, add to the weight of the jar. The bird must support itself on the air within the jar, and the jar must support the air with which it is filled.

Another Venomous Snake


T. G. G., DES MOINES, IOWA. The yellow-bellied sea snake is reported to be venomous. Human deaths from its bite are said to be on record.

Volcanoes in the U. S.

D. K. S., PHILADELPHIA, PA. No active volcano is to be found in the United States at present. Several Rocky Mountain peaks, however, emit vapor. Mt. Lassen, Calif., has been seen in eruption in the past.

Whence 'Kibitzer'?

B. J. M. B., WEST ORANGE, N. J. The origin of the word "kibitzer" is in nature lore, and does come from the German *kibitz*, the name of the green plover, lapwing, or peewit. This bird sits idly by in the fields during plowing, and watches the farmers. Such remarks as it makes from time to time in bird language are comparable to the sarcasms and idle comments of the spectator at a card game.



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EXPERIMENTS SHOW HOW SOLUTIONS BEHAVE

(Continued from page 47)

same chemical form—that is, similar salts.

Pure water boils at 100 degrees Centigrade, but chemicals dissolved in it, such as salt, will raise the boiling point. By additional salt, the boiling temperature may be further increased.

This fact has a useful application in the home laboratory when a mixture in a flask must be heated to a higher temperature than that of boiling water, but would be overheated if a free flame were used. All you need do is to fill a can with strong salt solution—or, better, strong calcium chloride solution—and to boil the liquid, having placed in it the vessel to be heated. As the heating solution evaporates, more water should be added to keep it at the same strength and consequently at a constant temperature. When still higher temperatures are needed, oil is usually substituted for strong chemical solutions.

SUBSTANCES dissolved in water have another effect on its behavior, for it will no longer freeze at the usual temperature, zero degrees Centigrade. For example, sea water, which contains approximately three percent of salt, freezes at minus two degrees.

Calcium chloride is another of the many substances that lower the freezing point of water. The effect is approximately proportional to the amount dissolved; and, as calcium chloride is freely soluble in water, its solution can be cooled to rather low temperatures without freezing. This property was seized upon some years ago by certain unscrupulous manufacturers who offered an anti-freeze compound for automobiles. The product was essentially calcium chloride, an inexpensive chemical to purchase, but which was sold under a trade name at a fancy price. Because of its corrosive action, this solution seriously damages metallic parts of an automobile; therefore it should never be introduced into a cooling system.

You can make a simple air thermometer that will allow you to observe the effect of dissolved substances upon the freezing point of the water used. This instrument consists of a small test tube and an inverted, U-shaped length of glass tubing. One leg of the tubing passes through a one-hole cork or rubber stopper in the mouth of the test tube; the other dips into a beaker of colored water. The latter part of the tubing should be from two to three feet long, and the whole system should be air-tight. The test tube serves as the bulb of the air thermometer, and the tubing as the stem. Warming the bulb expands the air it contains, and part of the air escapes in bubbles at the end of the tubing that dips in the colored water. Now, when the bulb is allowed to cool, the colored water rises.

FOR your experiments, place the "bulb" or test tube in a narrow container that holds the water. This, in turn, rests in another vessel. The space between the last two vessels is filled with shaved ice and salt. You also should fit a wire stirrer around the test tube so that you can mix and cool the water quickly by raising and lowering the wire.

When pure water is used, the colored liquid will rise in the glass tubing and stop when the water surrounding the "bulb" freezes. Place a marker on the tubing to indicate the temperature, as shown by the level of the column.

Now remove the freezing mixture of salt and water; allow the ice in the narrow chamber to melt to water. Add sugar or some other soluble substance and replace the vessel holding the freezing mixture. The colored solution will now ascend higher in the tubing because the water in the narrow vessel will have had its freezing point lowered by the substance dissolved in it; in this way you can contrast the effects of different chemicals.

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FOUR MILES A MINUTE IN A FLYING BABY BUGGY

(Continued from page 25)

toward another ship ready to take off. The pilot of that machine saw the runaway craft bearing down on him. He was alive to his danger, and quickly kicked right rudder and cut the switch. At the last instant, however, the runaway speed-plane straightened out and took off. But the other ship spun in a ground loop and was out of the race.

Oddly enough, the fastest plane in the air is often the slowest to get off. On the ground, my Menasco, for instance, will turn up only 1,850 revolutions a minute. Once in the air, however, it builds up to 2,950 revolutions. Usually, I take a 1,000-foot run in getting away, waiting until the bumping gets so bad I have to pull her off.

THE main danger point, once we are in the air, is the scattering pylon. All the ships converge here in a mad battle to be first down the front stretch. Seldom do I fly a race higher than forty feet above the ground, except when I am hopping over trees. Oftentimes, I skim so low my wheels seem to touch. The air conditions at these low altitudes are such that I can fly wide open with the nose of the ship below horizontal. Thus, in effect, I fly the race in a continual dive. In addition, low flying helps me keep ahead of the pack by preventing another pilot from diving under me in approaching the pylon.

It is rounding a pylon at 200 miles an hour that gives the real kick to racing, especially when three or four of us are closely bunched. I start building up my bank fully a quarter of a mile from the turning tower. So sensitive are the controls of my little plane that I ease the stick over almost imperceptibly. Any sudden movement or change in direction slows the ship down. If I cut around the pylon in a very tight bank, the plane will mush, squashing outward through the air as much as 100 feet. So I usually am from 200 to 300 feet outside the course when I near the turning tower, rounding the marker in a smooth curve that carries me flashing past within fifteen feet of the pylon.

During one race, a couple of years ago, I was fighting a nip-and-tuck battle with Roy Minor. He was at the stick of Benny Howard's famous little white racer, "Mike." As we whined into a turn, I was right on his tail. My right wing was pointing straight into the sky when my ship cut across his path. In a split second, his backwash flipped me completely upside down! My head was down and the wheels of my plane were up. In another split second, however, I had given her plenty of aileron and, rolling like a corkscrew boring through the air, was back in a vertical bank trailing the plane ahead. This narrow squeak had lost me altitude and when I skimmed over the trees beyond the pylon my wheels cleared them by a scant six feet.

TO ELIMINATE some of the hazard from closed-course racing, pilots are required to observe five rules:

1. The first man to reach the pole has the inside track. Others must turn high or low outside of him.
2. No plane may fly higher than 500 feet.
3. If a pilot cuts inside a pylon, he may pull up to a higher altitude, circle the tower and continue the race.
4. In passing another ship, pilots must be at least fifty feet outside of it and before cutting in in front they must be at least 150 feet ahead of it.
5. The winner has right of way in landing. He is followed by the others in the order in which they finish. A ship in trouble, however, can come down immediately.

On four different occasions, I have been "a ship in trouble," sitting down during races with

a dead stick. You may think zooming up a couple of thousand feet with a dead propeller, only to turn and sideslip in for a hot landing on tiny wheels, is fun; I don't. And I know what I am talking about.

Other pilots have limped in with cracked cylinder heads or burned-out pistons. But the times I have run into trouble . . . bing! . . . out! My fuel pump quit on the back-stretch during the International Air Races at Chicago. I was only thirty feet above the ground, streaking along with my nose down and my air-speed indicator pointing to 220. The engine quit without a cough. It was as dead as a doornail. My speed saved me, however, enabling me to shoot up to 2,000 feet and pick an open space where I could sit down at a mile-and-a-half-a-minute speed.

AT THE end of every race, I pull up into a vertical zoom, streaking upward like a rocket for several thousand feet. It kills my speed and gives the crowd a thrill. Then I slide down, level off, and ease the tiny wheels down on the runway. In case the field is rough, I mush in, giving the motor a blast immediately before contact.

The closest call I ever had in a speed landing occurred at Miami, Fla. A squirrel was the cause of it.

I sat down at the end of a race, coming in at ninety miles an hour. In rolling across the concrete runway, I lost a third of my speed. But I was still traveling a mile a minute when one wheel plunged in a hole dug by a ground squirrel. The twelve-inch tire exploded like a rifle cartridge. The plane bounded fifteen feet in the air and slued to one side. I kicked the rudder over, gave the engine a blast, and came down in a power stall. The only damage was smashed "pants" on the streamlined wheels.

And that reminds me. The field where the Pan-American Air Races are held is formed of filled-in ground on the shores of Lake Pontchartrain. We had to take off over the water, in every race. That was bad enough. But to make matters even worse, the spot was infested with something worse than squirrels—sea gulls. Each time we roared into the air, the gulls flapped out of the water and circled in flocks. To hit a bird head-on at high speed would have torn any one of our little ships to pieces.

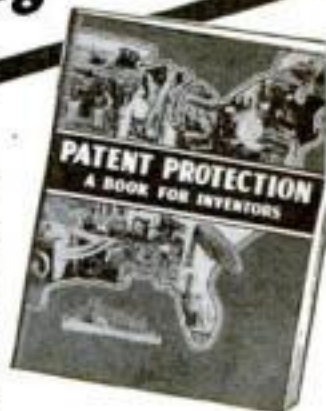
THE crowd couldn't understand the way we flew. We would be streaking along when suddenly we would zoom into the air, only to resume the race again. They thought we were crazy, until they saw Harold Newman limp down for a hazardous high-speed landing with fabric on his right wing torn into shreds. He had struck a gull a glancing blow.

Last year, at a meet in Omaha, Nebr., Gordon Israel, the sensational St. Louis, Mo., pilot, had his mosquito ship bounce out of control in a rough landing. Although he idled his motor, the plane kept crashing to earth and leaping into the air again until it finally somersaulted. Israel escaped with a few scratches.

There are valuable safety measures, of course. In order to keep aileron flutter at its absolute minimum, I attach especially chosen weights to the fronts of my ailerons, inside the wings. Statically balanced in this way, they are much less likely to start vibrating, than when they have not been weighted properly.

This modern barnstorming of ours, which carries us from field to field about the country, does more than provide thrills for the air race fans. Our closed courses are sky laboratories; we lead the way toward lighter, faster aircraft in the future.

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TANK CARS CARRY STRANGE CARGOES

(Continued from page 43)

Africa. The vessel must be emptied as soon as possible, because holding it costs hundreds of dollars a day. So strings of tank cars are filled at top speed, and head away for the soap factories of Cincinnati, Ohio; Boston, Mass., and Chicago, Ill.

Probably the greatest rush for tank cars on record occurred in the oil regions of the Southwest a couple of years ago. The week before the law limiting the production of oil went into effect, there was a grand scramble for cars to get the excess petroleum out of the territory.

IT WAS petroleum that introduced the tank car into the world of transportation. When oil was discovered in Pennsylvania, a search for new methods of shipping led to a curious flatcar, a gondola carrying two immense wooden tubs. From this early ancestor, the tank car developed into the familiar steel cylinder on wheels with a dome at the top to take care of the expansion of liquids within. Carrying from 8,000 to 10,000 gallons of oil, such cars have run in solid trains from Texas and Oklahoma fields to northern refineries.

Up to a few years ago, transporting petroleum was almost the entire work of the tank car. Today, hardly half the cars in operation are used for this purpose. The big containers have come into their own for hundreds of other tasks. Chemicals, high-pressure gases, and now solids are being conveyed rapidly and economically within the metal shells of their huge bodies.

The new tank car for solids, developed by engineers of the General American Transportation Corp., after several years of research, is solving a host of transportation problems. Take, for instance, the handling of quicklime.

This dangerous material, widely employed in removing hair from hides and in neutralizing acids in oil, will burn through the skin of a sweating man like fire. By using the new car, this danger is eliminated because endless chains remove the dust mechanically from the car. Pipe conveyors load and unload the car and shoveling or other handling is unnecessary.

In carrying cement, these cars save as much as two dollars a ton in transportation and handling costs. As each tank holds sixty tons, this means \$120 clipped from the expense to the manufacturer or construction company every time a load is delivered. An increasing number of the new cars are carrying dry materials of various kinds to all parts of the country. In one case, they are hauling thousands of tons of a certain kind of sand to a cleaning-compound plant. In another, they are delivering the same kind of sand for mixing with clay and feldspar to produce high-tension insulators for an electrical company.

BECAUSE dirt is entirely eliminated, the cars are life savers as well as money savers. Silicosis and other diseases caused by dust can be prevented by their use. Explosions resulting from filling the air with inflammable particles are cut to a minimum by tank-car transportation of dust-laden materials. Dangerous materials, such as arsenic for the production of insecticides, travel in the new cars.

A complete "passenger list" of products now carried in all types of tank cars would fill this page. It runs into hundreds of items. There are dyestuffs, pickles, olive oil, glue, cod-liver oil, tung oil, linseed oil, varnish, vinegar, whale oil, turpentine, alcohol, porpoise oil, shark oil, pitch, acids, creosote, pine tar oil, resins, ink, gelatin, and latex, the milk of the rubber tree. Out of Hoboken, N. J., one drug concern ships two or three 8,000-gallon tank cars filled with castor oil every

day. Another shipper uses them for sending embalming fluid and still another hauled 1,000 live fish from a Wisconsin lake to the eastern market.

Often, in meeting the special problems that arise in carrying so infinitely varied a list of products, engineers have to design unique cars to overcome individual difficulties. Such was the case with acetic acid. This fluid, vital to the rayon industry, will corrode iron or steel. Therefore, a special all-aluminum car, the first of its kind ever built, appeared on the rails two or three years ago. Engineers had said that aluminum, a relatively soft metal, would "cold-flow" and that the constant vibration would pull the riveted joints apart. Neither thing happened and the saving on the cost of transporting the acid is as much as \$175 a carload. The aluminum drums and glass carboys formerly used to carry the fluid had to be returned to the shipper empty, thus increasing the cost.

WHEN the same cars were tried out for carrying hydrogen peroxide, a curious fact cropped up. Peroxide corroded the aluminum that acetic acid did not disturb. A different alloy must be used in peroxide-carrying cars. It is specially heat-treated and the rivets, of the same alloy, must be heated in an electric furnace and driven in place while at a high temperature. These great containers, holding \$12,000 worth of peroxide at one filling, are playing an important part in cutting costs in several industries. The peroxide is used for bleaching cottons and other fabrics and for the preparation of furs. It is the only chemical known that will bleach the hairs without destroying the fur. Thus, rabbit and cat fur is first turned white then dyed to form imitations of rare furs for coats and neckpieces. In New York City and other fur centers, thousands of gallons of peroxide are used for this purpose.

Pulpwood paper, such as forms your newspaper, would be a dirty brown but for the bleaching effect of another chemical that travels by tank car. This is chlorine, also used for purifying city water supplies. It is carried in specially forge-welded tanks insulated by a four-inch layer of cork. It is loaded as a liquid at 20 degrees below zero, Fahrenheit. When it is unloaded, heating coils make it expand and flow out of the connecting pipes.

Regular tests are required on all tank cars by the Interstate Commerce Commission. At stated intervals, ranging from one to ten years, they must be examined for weaknesses. Many of the carriers have been in steady service since the first of the present century and are still in excellent condition. The price of a new tank car runs from about \$2,000 for an ordinary oil carrier to from \$8,000 to \$10,000 for the special nickel-clad job which has been introduced recently.

THIS car was designed for carrying caustic soda, widely used in soap and rayon plants. Ordinary steel cars cannot be used. If as much as one hundredth of one percent of iron gets in the soda, it interferes with its use for rayon making. The cars now used have the nickel bonded to the steel plates by a special process developed for the purpose. All rivets are made of solid nickel. Such containers, it is expected, will save the rayon industry nearly a million dollars a year.

One of the most versatile vehicles of transportation, the modern tank car, is transforming shipping methods. With its future applications almost unlimited, it has already reduced costs, raised quality and speeded distribution for a host of essential products. The tank car has proved to be of utmost importance to industry.

HOW TO ADJUST YOUR SHOCK ABSORBERS

(Continued from page 56)

then match up the rear ones. You don't have to have the rear ones match the front ones, so long as they match each other. In fact, it's usually better to have the back ones stiffer than the front ones."

"Of course," Gus continued, as he changed the adjustment of the rear absorbers and bounced the rear of the car up and down, "the real test of shock-absorber adjustment is the way they act when the going is rough. So if you'll just run me over that rutty piece of road back of the freight yard we'll put the final touches on 'em. Wait till I put some air in the tires so we won't have that to worry about."

THE street back of the freight yard was an ideal place to test the effect of shock absorbers. Heavy trucking had reduced the macadam surface to a succession of pot holes, ruts, and broken stones.

"Go over it fast, first," Gus suggested.

"It's lots better—just about right, I should say," Mary decided. Gus made no comment.

"Try it again, and go slower this time," he ordered.

"Goodness!" Mary exclaimed as the car bounced along in a most disturbing fashion at the slower speed. "Why should it ride so much worse at this speed than it does when I go faster?" she asked.

"In the first place," Gus explained, "you'll find that with any car and any particular stretch of bumpy road, there'll be one special speed that will make the car ride smoothest. Sometimes it's slow, and sometimes fast. It depends on the number and size of the holes and bumps, and on the kind of car, too. In the second place, all the shock absorbers on this car are a little too loose. Stop while I tighten 'em and we'll try again."

"There," he said, as they went over the stretch for the third time, "that's about right now. You see, young lady, the first step in adjusting shock absorbers is to get 'em equalized by bouncing the car up and down while it's standing still, and then get your final adjustment by testing over a rough road at different speeds."

"What would have happened if you'd set the absorbers too tight before we made this road test?"

"I was wondering if you'd bring that up," Gus grinned. "Well, if we'd tightened them too much the car would have ridden about the same at both speeds, but you'd not have enjoyed it. There'd have been no pitch or bounce. It would have trundled along like a farm wagon and you'd have felt every little bump in the road. The overtight shock absorbers would have kept the springs from doing their job of easing you over the bumps."

"THANKS a lot, Gus, for all the trouble you've taken," said Mary, when they got back to the Model Garage. "Now I know how to fix any car so it will ride as well as this one—just adjust the shock absorbers."

"I wouldn't go so far as to say that," Gus replied. "Remember that riding quality depends on a lot of things beside shock absorber adjustment. Some cars ride easier than others, no matter how you set the absorbers."

"You mean heavy cars ride better than light ones," Mary interrupted. "Of course, I understand that."

"No, I was thinking of cars in the same weight and price class. It isn't so much the weight of the car as it is the way the weight is distributed. They've learned a lot about balance and springing these last few years. For one thing, they are beginning to realize how important it is to put the passengers midway between the front and back wheels so they won't be tossed about."

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MECHANICAL FUN-MAKERS ADD TO CARNIVAL THRILLS

(Continued from page 52)

plained it was all due to skillful use of "the ball-bearing joints of the wrist." But what he didn't explain was a slight movement of his toe or his knee that touched a lever and shifted the string supporting the ball a quarter of an inch to one side. In that position, the feat was easy. But customers never had the same advantage unless it was good business.

IN THE familiar bucket game, where you win a prize if you can throw three balls into a bucket or keg and make them stay there, the dodge was ridiculously simple. At the bottom of the keg, in some cases, rubberized fabric was arranged so it could be drawn taut or left slack according to the desire of the operator. When he made a demonstration, the cloth was slack and the balls stayed in; when you tried it, the cloth was taut and they bounced out. In other instances, the wooden bottoms of the buckets were constructed so that the operator could tilt them at any angle desired. At one angle, they bounced the ball out of the container, at another they made it stay in.

Of all the common carnival games, the paddle wheel has been the one most often tampered with. Sometimes, an invisible wire applied friction to slow down the wheel as the operator desired. At other times, the wheel was controlled electrically. In either case, the spectators who tried their luck were bucking a game they couldn't beat.

Some of the booths were even rigged so that the mechanisms could be controlled from a number of places. The operator would move about while the wheel was spinning, touching a lever with his foot or knee just at the right time. In some instances, he even walked out of the booth and left the paddle wheel turning to prove to the spectators that the game was on the level. But they lost just the same. What they didn't notice was a man in the crowd who leaned on the counter of the booth watching the wheel. He was the shill, pressing a hidden mechanism in the edge of the counter and controlling the wheel.

Nowadays, most booth operators consider themselves as merchandisers and are content with a fair profit on their turnover. By giving away a prize that costs, wholesale, 49c or 59c every time the wheel turns, they make good money, with fourteen people putting down a dime apiece to try their luck.

ANOTHER factor in the disappearance of a "skin stuff" has been the larger crowds during the depression. The crowds were bigger, but the amount of money spent was smaller. The people came to look rather than spend. Most of the larger carnivals began charging a dime admission and as a result the importance of the games has decreased. The old favorites, where the individual tries out his own skill and strength, continue year after year to be the most popular.

In thinking of carnivals, many people have associated them with the crooked concessionaires who ran rigged apparatus and gyp games. They have overlooked the tremendous amount of good they have done in raising money for hospitals, churches, orphanages, and fraternal organizations. Sometimes, as much as \$3,000 a week has been turned over to a worthy cause by a large carnival.

In addition, there is the contribution of fun and amusement given to thousands of people in all parts of the country. With new thrill rides and mechanical laugh-makers being added from year to year, these present-day roving amusement parks more than ever justify the observation of William Allen White, the Kansas editor, who said:


"Carnivals are a part of the necessary gaiety of a civilized people."

WEATHER MAN THROWS COLD WATER ON ROMANCE



"HARD-TO-SHAVE" JAKE GETS A BREAK



A romantic couple stands in the rain. The man, on the left, wears a light blue suit and a straw boater hat. He is lighting a cigarette. The woman, on the right, wears a light blue jacket, a striped skirt, a striped scarf, and a straw boater hat. She holds a large, dark red umbrella over both of them. They are looking at each other and smiling. The background is dark with diagonal lines representing rain. A large, light-colored, cloud-like shape contains text in the center. At the bottom, a pack of Chesterfield cigarettes lies on the grass.

I struck a Match in the Rain —

*I struck a match amid the rain drops
While there we waited you and I.
A little flame revealed we both liked Chesterfield.
You know—I know—They Satisfy.*

*You smiled and said, "They do taste better"
And I replied, "They're milder, too."
Those words just fit them to the letter.
You know—I know—They're true.*

*And now we're furnishing a cottage
Where we'll be happy by and by.
Because the night we met, you held that cigarette.
You know—I know—THEY SATISFY.*

Chesterfield